



Tritex II Parameters Manual

Identification and Usage

Exlar Corporation

8/14/2013

This manual provides a detailed description of the MODBUS registers used for set-up, status monitoring, and operational control of the Tritex drive. The information presented may be used by customers implementing their own MODBUS Master interface to the drive or connecting a MODBUS Master MMI (Man-Machine Interface) device to the drive. The register descriptions will also be helpful for selecting the data to be transferred between the drive and a PLC (Programmable Logic Controller) or other device using the EtherNet/IP protocol.

Table of Contents

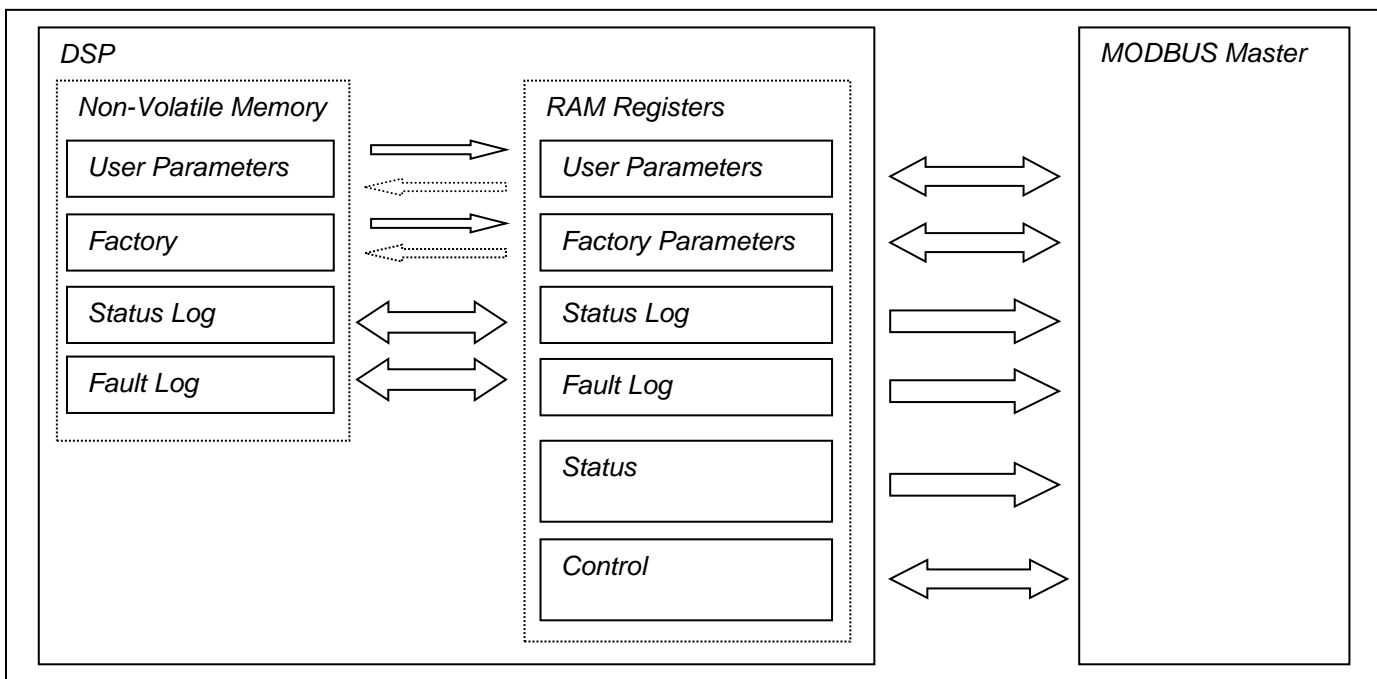
| | |
|--|----|
| Introduction..... | 4 |
| Memory Organization..... | 4 |
| User Parameters..... | 5 |
| Identification and Configuration..... | 5 |
| Drive Limits..... | 6 |
| Fault Control..... | 7 |
| Position Limits..... | 9 |
| Ethernet Parameters..... | 10 |
| MODBUS Parameter Registers..... | 11 |
| Tuning..... | 13 |
| Command Mode..... | 14 |
| Jog Control..... | 15 |
| Home Control..... | 16 |
| Dedicated Move Control..... | 17 |
| Move Control..... | 18 |
| Analog Motion Control..... | 19 |
| Analog Position Control..... | 19 |
| Analog Velocity Control..... | 19 |
| Analog Current Control..... | 20 |
| Velocity Override..... | 21 |
| Digital Input Assignments..... | 22 |
| Digital Output Assignments..... | 24 |
| Analog Input Parameters..... | 26 |
| Analog Output Parameters..... | 28 |
| Mapped Parameters..... | 29 |
| Factory Identification Parameters..... | 30 |
| Factory Actuator Parameters..... | 30 |
| Factory Limits Parameters..... | 32 |
| Factory Calibration Parameters..... | 32 |
| Factory Tuning Parameters..... | 34 |
| Factory Position Correction Table..... | 34 |
| Factory Commutation Table..... | 35 |
| Factory Communication Parameters..... | 35 |
| Status Registers..... | 36 |
| System Status Registers..... | 36 |
| Digital Input Status Registers..... | 38 |

| | |
|---|----|
| <i>Digital Output Status Registers</i> | 39 |
| <i>Analog Input Status Registers</i> | 40 |
| <i>Analog Output Status Registers</i> | 41 |
| <i>Analog Command Status Registers</i> | 41 |
| <i>Position and Velocity Status Registers</i> | 42 |
| <i>Current Status Registers</i> | 43 |
| <i>Command Status Registers</i> | 44 |
| <i>System Diagnostics Registers</i> | 46 |
| <i>ADC Status Registers</i> | 47 |
| <i>Factory Identification Registers</i> | 48 |
| <i>Command and Control Registers</i> | 49 |
| <i>Host Control</i> | 49 |
| <i>System Command</i> | 52 |
| <i>Digital Oscilloscope</i> | 54 |
| <i>Scope Control Registers</i> | 54 |
| <i>Scope Status Registers</i> | 56 |
| <i>Logs</i> | 58 |
| <i>Status Log</i> | 58 |
| <i>Fault Log</i> | 60 |
| <i>Appendix A - Types</i> | 63 |
| <i>Simple Types</i> | 63 |
| <i>STR16</i> | 64 |
| <i>FAULT</i> | 64 |
| <i>OPMODE</i> | 66 |
| <i>Input Event Groups</i> | 69 |
| <i>Output Event Groups</i> | 72 |
| <i>MOVE</i> | 76 |
| <i>Appendix B – Modbus Register IDs</i> | 79 |
| <i>Status and Control Registers Table</i> | 80 |
| <i>User Parameters Registers Table</i> | 85 |
| <i>Mapped Table Values Registers</i> | 94 |
| <i>Factory Parameters Register Table</i> | 97 |
| <i>Factory Identification Register Table</i> | 98 |

Memory Organization

In general, all *Tritex* register data may be considered to exist in *RAM (Random Access Memory)* where it is available for reading, writing, or both reading and writing. (Internally, some registers may be mapped directly to *ROM (Read-Only Memory)* or *DSP registers* or other areas but these exceptions are transparent to the user.) Within the *MODBUS* protocol, registers that are read-only are referred to as *INPUT* registers and registers that are both readable and writable are referred to as *HOLDING* registers.

The drive maintains parameter and other internally logged data in non-volatile memory so that the data values are saved between power-ups. During start-up initialization, all non-volatile memory data is copied to *RAM* where it is made available to the *MODBUS* interface. After start-up, all parameter *RAM* blocks will have been initialized from the data in their non-volatile memory image block. The non-volatile images for the *Status Log* and *Fault Log* are automatically updated as necessary when the *RAM* data changes. The writing of parameter register data, however, modifies only the current values in *RAM*. Future power-ups will again initialize the *RAM* parameter blocks to their original values retained in non-volatile memory. The copying (saving) of parameter *RAM* blocks to non-volatile memory is carried out only when specified through direct control commands.



User Parameters

User parameters are stored as a block in non-volatile memory. The block contains a *CRC (Cyclic Redundancy Checksum)* word to guarantee data integrity. At power-up, the user parameter block is validated and copied to its runtime location in *RAM* where all parameters are available for both reading and writing through their individual *MODBUS* registers.

Identification and Configuration

Identification / Configuration Parameters Register Table

| ID | Name | Type* | Description |
|------|--------------|--------|----------------------------|
| 5000 | DriveName | STR16 | User drive name |
| 5100 | Options | FLAGS | Configuration option flags |
| 5101 | PowerUpDelay | UINT16 | Power-up delay [0.01 SEC] |

*See Appendix A for details on data Types

DriveName

DriveName is a sixteen *ASCII* character string used only for display purposes. It is available to the user to provide a descriptive name for the drive. *DriveName* is displayed for informational purposes in the *Tritex* user interface software and in the interface software's network connection status information.

Options

Miscellaneous user configuration options are enabled through bit flags of the *Options* word as specified by the following bitmap table.

| | | | | | | | STUP | DMD | PLPCT | PLP | PLM | DIR | | TE | AE |
|----|----|----|----|----|----|---|------|-----|-------|-----|-----|-----|---|----|----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

AE Auto Enable

If *Auto Enable* is set, the drive continually forces the *Enable Maintained* input event active in the *InputEvents.Mode* register. The drive enabling action is exactly the same as it would be if the *Enable Maintained* input event were assigned to a continually active digital input.

TE Auto Teach Enable

If *Auto Teach Enable* is set, the drive continually forces the *Teach Enable* input event active in the *InputEvents.Mode* register. The drive's teach enabling functionality will be exactly the same as it would be if the *Teach Enable* input event were assigned to a continually active digital input.

The *TE* option eliminates the requirement for a *Teach Enable* input but should be used with caution since the individual move teach functionality is no longer safeguarded by the additional requirement of first activating the *Teach Enable*.

DIR Reverse Drive Polarity

The *DIR* option reverses the internal direction polarities of drive current, velocity, and distance. By convention, the drive always equates positive current with positive velocity and positive direction. If the *DIR* flag is set, this positive motion is defined to be counter-clockwise rotor movement for rotary actuators (as viewed looking towards the actuator from the shaft end), or retract shaft motion for linear actuators. If the *DIR* flag is not set (default), positive motion is defined as clockwise rotor movement or linear shaft extension.

If *DIR* is modified, the *Homed* output status event will be cleared since the definition of all absolute positions has also effectively been modified. The drive may need to be re-homed to establish a new absolute position reference frame before motion is allowed.

PLM Position Limit Minus Enable

PLP Position Limit Plus Enable

The *PLM* and *PLP* options enable the negative and positive *Position Limits*, respectively. Position limit functionality is described in the *Position Limits* section.

PLPCT Position Limit Percent Enable

The *PLPCT* option enables the drive's position limits to be calculated automatically as a percent of the *Analog Position Mode* range of position. Position limit functionality is described in the *Position Limits* section.

DMD Dedicated Move Disable

The *Dedicated Move Disable* option will set the *EMOVE* flag in the *Disables* register (forcing the drive to become disabled) when a *Dedicated Move* terminates and the *At Dedicated Move Position* output event becomes active.

STUP Startup Required

The *STUP* option requires that *Startup Complete* is active before allowing operation in any mode. No motion commands other than *Startup* will be acted upon.

PowerupDelay

The *PowerupDelay* register specifies a time delay period at start-up during which the drive will remain idle before initializing the system. During this idle time the digital outputs will not be driven and the communication channels will not be available. Once the delay time has expired, the drive will execute its normal start-up routine. *PowerupDelay* is specified in 0.01 second units.

Drive Limits

Registers described in this section control various global parameters used by the drive at runtime. Parameter registers specific to the drive's position limits are covered separately in the *Position Limits* section.

Drive Limits Parameters Register Table

| ID | Name | Type* | Description |
|------|------------------------------|--------|--|
| 5108 | <i>Ipeak</i> | UCUR16 | User current command limit [9.7 AMPS] |
| 5110 | <i>StopAccel</i> | UACC32 | Stop acceleration [12.20 RPS/S] |
| 5112 | <i>InPositionWindow</i> | UPOS32 | In position window width [16.16 REVS] |
| 5114 | <i>MaxFollowingError</i> | UPOS32 | Position error limit [16.16 REVS] |
| 5116 | <i>InPositionTime</i> | UINT16 | Time to in-position [ms] |
| 5117 | <i>MaxFollowingErrorTime</i> | UINT16 | Time to in-position [0.01 SEC] |
| 5129 | <i>InCurrentLimitTime</i> | UINT16 | In current limit hysteresis time [0.1 SEC] |

***See Appendix A for details on data Types**

Ipeak

The maximum current command allowed under normal operation is set to the minimum of the factory limits *Ipeak* parameter and the user's *Ipeak* parameter. The maximum allowable current command may be lowered during *Host Mode* operation to the value specified in *Host.Current* and also when operating outside of the drive's position limits, moving, or jogging if specific current limit options are enabled.

StopAccel

The drive uses the acceleration limit specified in *StopAccel* when decelerating to zero velocity due to an active *STOP* input event. *StopAccel* is also used when aborting motion for other internal reasons such as an active hard fault which has been selected to stop the drive without disabling. *StopAccel* should normally be set to the highest value that will safely stop motion without undue stress on the drive or machine mechanics.

InPositionWindow

InPositionWindow sets the maximum position error allowed at zero velocity before the *In Position* output status event can be activated. The *In Position* output status event will be active whenever command velocity is zero, the absolute value of position error (command position – feedback position) is less than *InPositionWindow*, and the *InPositionTime* criteria (below) has been met.

During *Analog Position* and *Analog Velocity* modes of operation, the velocity command signal will usually have some small amount of noise even when the drive's position appears to be constant. The non-zero velocity command may keep the *In Position* output status event from activating.

Note that since the absolute value of position error is used, the 'window' is actually twice the position width specified by *InPositionWindow*.

InPositionTime

InPositionTime sets the hysteresis time for the *In Position* output status event. The time is specified in milliseconds. An internal countdown timer is continually reinitialized to the *InPositionTime* value while the command velocity is non-zero or the absolute value of position error is greater than *InPositionWindow* (above). The *In Position* output status event will be active whenever the timer value is zero.

MaxFollowingError

MaxFollowingError sets the maximum position error allowed before a *Following Error* fault is activated. Whenever the absolute value of position error (command position – feedback position) is greater than *MaxFollowingError* and the *MaxFollowingErrorTime* criteria (below) has been met the *Following Error* fault will be active.

When operating in one of the current command modes, the positioning loop is not active and position command is continually set to the value of position feedback. Since position error is always zero during current command modes, a *Following Error FAULT* will never be generated.

MaxFollowingErrorTime

MaxFollowingErrorTime sets the hysteresis time for the *Following Error* fault. The time is specified in hundredths of a second. An internal countdown timer is continually reinitialized to the *MaxFollowingErrorTime* value while the absolute value of position error remains less than *MaxFollowingError*. A *Following Error* fault will be activated if the timer values counts down to zero (i.e. the absolute value of position error has remained greater than *MaxFollowingError* for at least *MaxFollowingErrorTime*).

InCurrentLimitTime

InCurrentLimitTime sets the amount of time the drive must be current limiting before triggering the *In Current Limit* output status event.

Fault Control

The registers described in this section are used to control the drive's behavior upon the occurrence of a *FAULT* event. The specific faults that are monitored by the drive are described in the *FAULT* data type. **(See Appendix B for the definition of the *FAULT* data type bitmap.)**

Fault Control Register Table

| ID | Name | Type* | Description |
|------|------------------------|--------|--|
| 5102 | FaultDisables | FAULT | Disabling FAULTs |
| 5103 | FaultWarnings | FAULT | Warning FAULTs |
| 5104 | FaultStop | FAULT | Stopping FAULTs |
| 5105 | FaultDedicatedMove | FAULT | Dedicated move FAULTs |
| 5130 | FaultLogFaults | FAULT | Fault log FAULT enables |
| 5139 | FaultDisables2 | FAULT | Disabling FAULTs for 2 nd 16 |
| 5140 | FaultWarnings2 | FAULT | Warning FAULTs for 2 nd 16 |
| 5141 | FaultStop2 | FAULT | Stopping FAULTs for 2 nd 16 |
| 5142 | FaultDedicatedMove2 | FAULT | Dedicated move FAULTs for 2 nd 16 |
| 5138 | FaultLogFaults2 | FAULT | Fault log FAULT enables for 2 nd 16 |
| 5132 | FaultResetDelay | UINT16 | Fault auto-reset delay [0.01 SEC] |
| 5133 | FaultLogDelay | UINT16 | Delay before logging faults [0.01 SEC] |
| 5143 | Low_VoltageDC_Warn_On | INT16 | Voltage at which Low voltage warning goes on |
| 5144 | Low_VoltageDC_Warn_Off | INT16 | Voltage at which Low voltage warning goes off |

*See Appendix A for details on data Types

FaultDisables and FaultDisables2

Faults selected in *FaultDisables/FaultDisables2* will cause the drive to disable when the fault occurs. The disabling may be delayed in order for the drive to stop under controlled conditions if the fault is also set in *FaultStop*. Faults selected in *FaultDisables/FaultDisables2* are also referred to as 'hard faults' and will require a rising edge of the *Reset Faults*, *Enable Momentary*, or *Enable Maintained* input events to reset the fault and re-enable the drive. The *Faulted* output status event will be active while a hard fault is active.

CAUTION

Removing faults from the *FaultDisables* register may lead to permanent damage of the drive or actuator. It is up to the user to take appropriate action on any faults that do not automatically disable the drive.

FaultWarnings and FaultWarnings2

Faults selected in *FaultWarnings/FaultWarnings2* will cause the *Warning* output status event to become active. The warning indication will be automatically removed if the fault later becomes inactive. The drive is not disabled (unless the fault is also selected in *FaultDisables/FaultDisables2*) and continues normal operation. Faults selected in *FaultWarnings* are also referred to as 'soft faults'. Soft faults should be monitored by the user so that appropriate action may be taken.

FaultStop and FaultStop2

Faults selected in *FaultStop/FaultStop2* will cause the drive to do a controlled stop of all motion. If the drive is operating in a current command mode it will first be forced into an internal position control mode. Drive motion is forced to zero velocity using the acceleration specified in the *StopAcceleration* register. Once motion has been stopped, the drive will disable if the fault has also been selected in the *FaultDisables/FaultDisables2* register. If the fault has not been selected in *FaultDisables/FaultDisables2*, the drive will hold position and remain enabled. While the drive remains enabled with the fault pending it will continually attempt an automatic fault reset at the rate specified in the *FaultResetDelay* register. The fault may also be reset at any time with the *Reset Faults* input event.

FaultDedicatedMove and FaultDedicatedMove2

Faults selected in *FaultDedicatedMove/FaultDedicatedMove2* will automatically execute the *Dedicated Move* when the fault occurs. If the drive is operating in a current command mode it will first be forced into the internal position control mode. Once the *Dedicated Move* has completed, the drive will disable if the fault has also been selected in the *FaultDisables/FaultDisables2* registers. If the fault has not been selected in *FaultDisables/FaultDisables2*, the drive will hold position and remain enabled. While the drive remains enabled with the fault pending it will continually attempt an automatic fault reset at the rate specified in the *FaultResetDelay* register. The fault may also be reset at any time with the *Reset Faults* input event.

FaultLogFaults and FaultLogFaults2

Faults selected in *FaultLogFaults/FaultLogFaults2* will be logged in the Fault Log when they occur. Faults may be selected for logging even if they are not selected in any other fault action register. The logging of a new fault is delayed by time period specified in *FaultLogDelay* to avoid filling the fault log with faults that may occur regularly when power is removed.

FaultLogDelay

FaultLogDelay sets the time delay between the occurrence of a fault and logging of the fault in the *Fault Log*. *FaultLogDelay* is specified in 0.01 second units.

FaultResetDelay

The *FaultResetDelay* sets the rate at which automatic fault resets are attempted for faults that have been selected in the *FaultStop* or *FaultDedicatedMove* registers but are not selected in the *FaultDisables* register. *FaultResetDelay* is specified in 0.01 second units. The automatic fault reset may be appropriate to recover automatically from an analog input *Loss of Signal* when the signal returns to the valid operating range or to continue motion execution using *Move Maintained Initiate* input events.

Low_VoltageDC_Warn_On

Low_VoltageDC_Warn_On is the level at which the voltage must drop in order for the Low DC warning to go on. By default, it is set to zero which disables it.

Low_VoltageDC_Warn_Off

Low_VoltageDC_Warn_Off is the level at which the voltage must rise to in order for the warning to go away. For proper operation, this value must be greater than *Low_VoltageDC_Warn_Off* and the difference should be great enough to prevent the warning from flickering on and off. By default, it is set to zero.

Position Limits

Position limits are software monitored travel limits with special features for control outside of the travel limits. The limits may be individually enabled and, once enabled, will be monitored in all operating command modes. The positioning algorithms in the controller will *'look ahead'* to anticipate a position limit being reached and reduce speed, if necessary. Once a position limit has been passed, reduced current commands may be put into effect for various application control options.

In addition to the parameters listed in this section, the *Configuration.Options* parameter contains the following flags that govern the behavior of the drive's position limits.

PLM - Position Limit Minus Enable

PLP - Position Limit Plus Enable

PLPCT - Position Limit Percent Enable

Position Limits Registers Table

| ID | Name | Type* | Description |
|------|--------------------|--------|--|
| 5118 | PlimitMinus | POS32 | S/W (-) position limit [16.16 REVS] |
| 5120 | PlimitPlus | POS32 | S/W (+) position limit [16.16 REVS] |
| 5122 | PlimitPercentMinus | UINT16 | S/W (-) position limit percent [1.15 %] |
| 5123 | PlimitPercentPlus | UINT16 | S/W (+) position limit percent [1.15 %] |
| 5124 | PlimitVelocity | UVEL32 | Position limit velocity limit [8.24 RPS] |
| 5126 | Plimitfoldback | UCUR16 | Position limit foldback current [9.7 AMPS] |
| 5127 | Plimitpeak | UCUR16 | Position limit peak (seating) current [9.7 AMPS] |
| 5128 | PlimitpeakTime | UINT16 | Position limit seating time current [ms] |

***See Appendix A for details on data Types**

PlimitMinus

PlimitPlus

The *PlimitMinus* and *PlimitPlus* set the negative and positive position limits, respectively. The drive always attempts to reduce speed to the position limit velocity limit before moving on to or past an enabled position limit. These registers are not used if current limit positions have been selected to be a percentage of the analog input range.

PlimitPercentMinus

PlimitPercentPlus

These registers specify the position limits as a percent of the analog input range. The values are only used if the percentage of range option has been selected, in which case the *PlimitMinus* and *PlimitPlus* values are ignored. Specifying positions as a percentage of range avoids having to change the limits when the position range of the analog input is modified for *Analog Position* command mode.

PlimitVelocity

The *PlimitVelocity* register sets the maximum velocity command allowed while outside of the position limits. A zero value will force the drive to a stop until motion is commanded in a direction opposite that of the active limit. A non-zero value will force to drive to continue in the direction of the active limit with the position limit foldback current in effect.

The *PlimitVelocity* register will not be used if the operating mode is a current control mode while the limit is active.

Plimitfoldback

The *Plimitfoldback* register sets the maximum current command allowed while outside of the position limits. The reduced current command limits are in effect only for motion in the direction that activated the position limit – full current is available to move in the direction opposite that of the limit (and to decelerate the drive towards zero speed).

Plimitpeak

PlimitpeakTime

The *Plimitpeak* and *PlimitpeakTime* registers set a maximum current and time to command this maximum current after a current limit is hit. A higher momentary peak may be useful, for example, as a momentary *seating* current. Once the specified time period has elapsed, the maximum allowable current command will drop back to the foldback current value. If a momentary limit is not required it may be set to the same value as the foldback current.

Position limits can only become active if they have been enabled and the absolute position reference frame has been established.

Ethernet Parameters

Ethernet parameter registers are used by a *Tritex* drive that has an optional *Ethernet* communications module installed. Most *Ethernet* module parameters are configured at the factory when the option board is installed and are preconfigured to control the internal *MODBUS Master* serial channel used between the option board and the drive. The few parameters that require customer configuration are described in this section.

Ethernet Parameters Register Table

| ID | Name | Type* | Description |
|------|---------|--------|--------------------------------|
| 5150 | IP | UINT32 | IP (Internet Protocol) Address |
| 5152 | Subnet | UINT32 | Subnet Address |
| 5154 | Gateway | UINT32 | Gateway Address |

***See Appendix A for details on data Types**

IP

Subnet

Gateway

These registers specify the *IP*, *Subnet*, and *Gateway* addresses used when an *Ethernet* option board is present. The *Ethernet MODBUS Master* reads the values at start-up, if needed.

MODBUS Parameter Registers

The *MODBUS* registers configure the *RS485* serial communications channel.

MODBUS Parameters Register Table

| ID | Name | Type* | Description |
|------|---------|--------|---|
| 5300 | Flags | FLAGS | Modbus Serial Channel A options |
| 5301 | AxisId | UINT16 | Modbus Serial Channel A axis identifier |
| 5302 | Baud | BAUD | Modbus Serial Channel A baud identifier |
| 5303 | RxDelay | UINT16 | Modbus Serial Channel A extra RX delay |
| 5304 | TxDelay | UINT16 | Modbus Serial Channel A extra TX delay |

*See **Appendix A** for details on data Types

Flags

The *Flags* register selects the hardware framing options as specified in the following bitmap table.

| | | | | | | | | | | | | | S2 | NP | OP |
|----|----|----|----|----|----|---|---|---|---|---|---|---|----|----|----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

OP - Parity selection

- 0 = EVEN parity
- 1 = ODD parity

NP - Parity bit enabling

- 0 = parity ENABLED
- 1 = parity DISABLED

When parity is DISABLED, the serial channel will automatically be set for two stop bits to keep the standard *MODBUS* frame at ten bits (1 start, 8 data, 2 stop), regardless of the **S2** option selection.

S2 - Stop bit selection

- 0 = one stop bit
- 1 = two stop bits

When two stop bits are selected, the serial channel will always transmit two stop bits which will result in an 11-bit (non-standard *MODBUS*) frame if parity is also enabled. This option may normally be left at 0 (one stop bit), since an extra stop bit is automatically added when parity is disabled.

AxisId

The *AxisId* specifies the *MODBUS* axis identifier used in *MODBUS* commands to and from the drive.

Baud

The value set for the serial channel's baud rate must be a value from the *BAUD Enumerations Table*. Baud rates above 38400 bps are specified with a value equal to 1/150th of the desired baud rate.

BAUD Enumerations Table

| Value | Baud (bps) | Description |
|-------|------------|--------------------|
| 4800 | 4800 | baud = value |
| 9600 | 9600 | |
| 19200 | 19200 | |
| 38400 | 38400 | |
| 32 | 4800 | baud = value * 150 |
| 64 | 9600 | |
| 128 | 19200 | |
| 256 | 38400 | |
| 384 | 57600 | |
| 512 | 76800 | |
| 625 | 93750 | |
| 768 | 115200 | |
| 1250 | 187500 | |
| 1536 | 230400 | |
| 3072 | 460800 | |
| 6144 | 921600 | |

RxDelay

Standard *MODBUS* communication protocol requires that serial characters be transmitted back-to-back and specifies that a frame idle time of 1.5 character times is an end-of-command indication. *RxDelay* may be used to extend the frame idle time required before assuming an end-of-command condition. Extra delay may be useful for a slow *MODBUS Master* that cannot guarantee back-to-back character transmission. The value is specified in milliseconds.

TxDelay

Standard *MODBUS* communication protocol requires a minimum 3.5 character time frame idle delay between transmissions. *TxDelay* may be used to extend the frame idle time between the receipt of the command and the transmission of the response. Extra delay may be useful for a slow *MODBUS Master* or an *RS485* device that requires extra time to tri-state the bus after transmitting. The value is specified in milliseconds.

The *RxDelay* and *TxDelay* registers (unlike *Flags*, *Baud* and *AxisID*) become effective as soon as they are modified. This allows the new values to be tested before committing them to non-volatile memory. It is recommended that changes to *RxDelay* and *TxDelay* be tested before saving parameters to avoid communication issues that may occur at start-up with untested parameters.

The drive's proprietary motion control algorithms have been designed to minimize the user's tuning requirements and provide for adequate performance with default tuning parameter values. The overall inertia (KJ) may need adjustment for larger system inertia variations. If necessary, the proportional (KP) and integral (KI) terms may then be individually adjusted for optimal performance. Feed-forward (KFF) and damping (KD) terms may normally be ignored and left at their default settings of zero. The drive will recalculate all necessary internal run-time gain scaling factors as necessary when changes are made to any tuning parameter.

Tuning Parameters Register Table

| ID | Name | Type* | Description |
|------|------|--------|---|
| 5400 | KJ | UINT16 | Inertia gain [6.10] |
| 5402 | KP | UINT16 | Position loop bandwidth [8.8 1/s] |
| 5403 | KI | UINT16 | Velocity integral time constant [8.8 1/s] |
| 5404 | KFF | UINT16 | Feed forward velocity scale [0.16] |
| 5405 | KD | UINT16 | Velocity damping [0.16] |

***See Appendix A for details on data Types**

KJ

KJ controls the overall inertia gain of the system. In general, default tuning values for KP and KI should provide reasonable loop performance and the KJ term should be adjusted first for the system inertia. Changes to KJ will linearly affect the internal runtime values for both the proportional (KP) and integral (KI) terms.

KP

KP controls the overall response of the position loop. Larger values increase will increase positional stiffness and reduce positional error. KP values that are too high may cause instability.

KI

KI controls the rate of integration of the positional error. Higher KI values will add stiffness and improve positional holding accuracy at a stop. KI values that are too high may cause overshoot and instability.

KFF

KFF provides open loop feed-forward velocity that sums with the velocity command generated from the positional error signal. KFF tends to reduce position error and may be a better alternative than higher KP and KI settings which may cause instability.

KD

KD is used to reduce velocity gain proportional to the speed. Increasing KD will smooth out higher velocity instabilities but will increase run-time position error. KD should not normally be used in combination with KI (integral gain) as the two terms may tend to fight each other.

Command Mode

The command mode parameter registers select the operational command modes available during normal drive operation. Normal operation, for the purposes of command mode selection, means that the drive is enabled, not stopped or in a fault condition, homing requirements (if any) have been satisfied, and no host controller has overridden the command mode by specifying a direct command mode of its own.

The specific operating modes available to the drive are defined by the *OPMODE* data type. **(See Appendix B for the definition of the *OPMODE* data type and its enumeration values.)**

Operation Mode Parameters Register Table

| ID | Name | Type* | Description |
|------|--------------------|--------|----------------------------------|
| 5106 | DefaultCommandMode | OPMODE | Main command mode selection |
| 5107 | AltCommandMode | OPMODE | Alternate command mode selection |

*See Appendix A for details on data Types

DefaultCommandMode

The operational command mode specified by the *DefaultCommandMode* register will be in effect during normal drive operation while the *Alternate Mode* input event is inactive. While the *DefaultCommandMode* register is being used for the source of the drive's operational command mode, the *Default Mode* output status event will be active.

AltCommandMode

The operational command mode specified by the *AltCommandMode* register will be used instead of the *DefaultCommandMode* while the *Alternate Mode* input event is active during normal drive operation. While the *AltCommandMode* register is being used for the source of the drive's operational command mode, the *Alternate Mode* output status event will be active.

The command operating mode actually in effect at any moment is available in the *Command.Mode* status register.

The *Jog* parameters control the profile motion commanded by the drive while the *Jog Positive* or *Jog Negative* input events are active. Active jog input events are normally accepted when the command mode is *Digital Inputs* and other move motion is inactive. The jog input events may optionally be allowed to override a command mode's active motion through the *DMO* and *AMO* option flags.

Jog Parameters Register Table

| ID | Name | Type* | Description |
|------|--------------|--------|-------------------------------|
| 6020 | Options | FLAGS | Option flags |
| 6022 | SlowVelocity | UVEL32 | Jog command target velocity 1 |
| 6024 | FastVelocity | UVEL32 | Jog command target velocity 2 |
| 6026 | Acceleration | UACC32 | Jog acceleration limit |

***See Appendix A for details on data Types**

Options

General jogging options are enabled through bit flags of the *Options* word as specified by the following bitmap table.

| | | | | | | | | | | | | | | | |
|---------------|----|----|----|----|----|---|---|---|---|---|---|---|------------|------------|---|
| ILIMIT | | | | | | | | | | | | | AMO | DMO | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

DMO

The *DMO* option allows the *Jog Positive* and *Jog Negative* input events to override the command mode in effect when the *Default Operating Mode* is active. Jog events will not be given priority over an active *Home* or *Dedicated Move*.

AMO

The *AMO* option allows the *Jog Positive* and *Jog Negative* input events to override the command mode in effect when the *Alternate Operating Mode* is active. Jog events will not be given priority over an active *Home* or *Dedicated Move*.

ILIMIT

The *ILIMIT* option may be set to limit the maximum current command allowed while jog motion is active to the value for the *Plimitfoldback* register (see *Position Limits*). Limiting the current command while jogging may be useful when the drive may be jogged into a hard stop.

SlowVelocity

The *SlowVelocity* register specifies the absolute value of the velocity commanded while jog is active and the *Jog Fast* input event is inactive. The drive will ramp the velocity command to the *SlowVelocity* using the *Acceleration* rate.

FastVelocity

The *FastVelocity* register specifies the absolute value of the velocity commanded while jog is active and the *Jog Fast* input event is active. The drive will ramp the velocity command to the *FastVelocity* using the *Acceleration* rate.

The 'slow' and 'fast' designations are simply naming conveniences to distinguish between the two velocities. The default values and the *Tritex* user interface software will normally have the lower speed value set in the 'slow' parameter. There is no actual requirement, however, that the 'slow' velocity be less than the 'fast' velocity and these registers may be set to any velocity values. The 'fast' and 'slow' velocities are simply the command velocity targets set for jog motion when the *Jog Fast* input event is active or inactive, respectively.

Acceleration

The *Acceleration* register specifies the absolute value of the acceleration rate used to achieve the velocity commanded while jog mode is active. The *Acceleration* rate is also used to achieve zero velocity when the jog input events become inactive while jogging. Once the jog input events become inactive, jog mode remains active until the command velocity has been ramped to zero.

Home operation:

The Home function can be initiated from the following methods:

1. The Home Input function from either an assigned digital input
3. Home button on the Control Page
4. From a host using Modus address control.
5. Automatically Home when the actuator is enabled, if the Homed status is not active.

The motion parameters for the Home move are defined by the MOVE data type.

(See Appendix B for the definition of the MOVE data type registers and MOVE profile motion.)

Home Parameters Register Table

| ID | Name | Type* | Description |
|------|-----------|-------|---------------------------|
| 6000 | Options | FLAGS | Home option flags |
| 6002 | Position1 | POS32 | Home reference position 1 |
| 6004 | Position2 | POS32 | Home reference position 2 |
| 6406 | Move | MOVE | Home motion parameters |

*See Appendix A for details on data Types

Options

Miscellaneous general homing options are enabled through bit flags of the Options register.

| AUTO | | OM_ALT | OM_DEF | | | | | | | | | | | | |
|------|----|--------|--------|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

AUTO

The AUTO option enables automatic Home move execution whenever the drive is enabled and the absolute position reference frame has not yet been established.

OM_ALT

The OM_ALT option requires the absolute position reference frame to have been established before the Alternate Operating Mode is allowed to become active.

OM_DEF

The OM_DEF option requires the absolute position reference frame to have been established before the Default Operating Mode is allowed to become active.

Position1

Position1 defines the absolute reference frame position set upon completion of a MOVE with the REF1 flag set in the Move.Options parameter.

Position2

Position2 defines the absolute reference frame position set upon completion of a MOVE with the REF2 flag set in the Move.Options parameter.

Move

The Move registers define the profile motion for the home in the common move format defined by the MOVE data type. **(See Appendix B for the definition of the MOVE data type and specific parameter IDs.)**

Dedicated Move Control

The *Dedicated Move* is designed to provide a method, available from any mode, to move to a specified position. The *Dedicated Move* has priority in all operating modes and will override any active motion other than an active *Home* move. The *Dedicated Move* is assumed to be set-up as a move to absolute position and the absolute position reference frame must be defined before a *Dedicated Move* will be allowed to execute. The motion parameters for the *Dedicated Move* are defined by the *MOVE* data type.

(See Appendix B for the definition of the *MOVE* data type registers and *MOVE* profile motion.)

In addition to the dedicated move registers described below, the operation of the dedicated move is also controlled by the *DMD* option in the *Configuration.Options* register which may be set to force the drive to become disabled upon completion of the move.

Dedicated Move Parameters Register Table

| ID | Name | Type* | Description |
|------|-------|-------|---|
| 6388 | Emove | MOVE | Dedicated (emergency) move motion motion parameters |

***See Appendix A for details on data Types**

Emove

The *Emove* registers define the profile motion for the dedicated move in the common move format defined by the *MOVE* data type. The move parameters for the dedicated move will normally be set-up to execute a move to an absolute position.

Move Control

The *Tritex II* is capable of storing and controlling up to 16 move profiles. Moves may be executed through the *Move Maintained* and *Move Momentary* input events when the drive's operational command mode is Digital I/O. The motion parameters for a move is defined by the *MOVE* data type.

(See Appendix B for the definition of the MOVE data type registers and MOVE profile motion.)

Move Parameters Register Table

| ID | Name | Type* | Description |
|------|---------|-------|---------------------------|
| 6100 | Move.0 | MOVE | Move 0 motion parameters |
| 6118 | Move.1 | MOVE | Move 1 motion parameters |
| 6136 | Move.2 | MOVE | Move 2 motion parameters |
| 6154 | Move.3 | MOVE | Move 3 motion parameters |
| 6172 | Move.4 | MOVE | Move 4 motion parameters |
| 6190 | Move.5 | MOVE | Move 5 motion parameters |
| 6208 | Move.6 | MOVE | Move 6 motion parameters |
| 6226 | Move.7 | MOVE | Move 7 motion parameters |
| 6244 | Move.8 | MOVE | Move 8 motion parameters |
| 6262 | Move.9 | MOVE | Move 9 motion parameters |
| 6280 | Move.10 | MOVE | Move 10 motion parameters |
| 6298 | Move.11 | MOVE | Move 11 motion parameters |
| 6316 | Move.12 | MOVE | Move 12 motion parameters |
| 6334 | Move.13 | MOVE | Move 13 motion parameters |
| 6352 | Move.14 | MOVE | Move 14 motion parameters |
| 6370 | Move.15 | MOVE | Move 15 motion parameters |

***See Appendix A for details on data Types**

Analog Motion Control

An analog input may be set up as a position command, a velocity command or a current Command. Each command mode uses its own set of parameters to specify the desired motion.

Analog Position Control

Analog Position Control provides position control proportional to the analog input value, the input is continuously updated and scaled to provide an Analog Command position, if the *Analog Position Control* is active from Default, Alternate or Host Modes the drive will position to the command while following the Velocity and Acceleration limits as specified on the page. The Acceleration Limit is also used as the deceleration limit.

Analog Position Control Parameters Register Table

| ID | Name | Type* | Description |
|------|--------------|--------|--------------------------------|
| 7101 | Channel | UINT16 | Analog input channel |
| 7102 | Minimum | POS32 | Position (minimum) |
| 7104 | Maximum | POS32 | Position (maximum) |
| 7106 | Velocity | UVEL32 | Positioning velocity limit |
| 7108 | Acceleration | UACC32 | Positioning acceleration limit |
| 7188 | ModbusCtrl | UINT16 | Modbus Control of position |

*See Appendix A for details on data Types

Channel

The *Channel* register selects the analog input to be used for monitoring the position command. It can also be set to be controlled via Modbus address 7190.

Minimum

Maximum

The *Minimum* and *Maximum* registers specify the target absolute positions corresponding to analog input's minimum and maximum values, respectively. These registers define the absolute position range of the analog control input.

Velocity

The *Velocity* register specifies the absolute value of the maximum command velocity used during the profile.

Acceleration

The *Acceleration* register specifies the absolute value of the maximum command acceleration rate used during the profile.

Modbus Ctrl

The *Modbus Ctrl* register specifies the velocity if the Channel is set to '2'.

Analog Velocity Control

Analog Velocity Control provides velocity control proportional to an analog input value. The input is continuously updated and scaled to provide an Analog Command velocity. If the *Analog Velocity Control* is active from Default, Alternate or Host Modes the drive will operate as velocity control following the Acceleration limit as specified on the page. The Acceleration Limit is also used as the deceleration limit. In Analog Velocity Mode, position control is the responsibility of the users control system.

Analog Velocity Control Parameters Register Table

| ID | Name | Type | Description |
|------|---------|--------|----------------------|
| 7117 | Channel | UINT16 | Analog input channel |
| 7118 | Minimum | VEL32 | Velocity (minimum) |
| 7120 | Maximum | VEL32 | Velocity (maximum) |

| | | | |
|------|--------------|--------|--------------------|
| 7102 | Acceleration | UACC32 | Acceleration limit |
| 7189 | Modbus Ctrl | UINT16 | Analog Velocity |

Channel

The *Channel* register selects the analog input to be used for monitoring the velocity command. It can also be set to be controlled via Modbus address 7189.

Minimum

Maximum

The *Minimum* and *Maximum* registers specify the command velocities corresponding to analog input's minimum and maximum values, respectively. These registers define the speed range of the analog control input.

Acceleration

The *Acceleration* register specifies the absolute value of the maximum command acceleration rate used to ramp to the analog signal's commanded velocity.

Modbus Ctrl

The *Modbus Ctrl* register specifies the velocity if the Channel is set to '2'.

Analog Current Control

Analog Current Control provides a current command proportional to an analog input value. If the Analog Current Control is active from Default, Alternate or Host Modes the drive will operate as torque / force control. In *Analog Current* control velocity and position control are the responsibility of the users control system.

Analog Torque Control Parameters Register Table

| ID | Name | Type* | Description |
|------|-------------|--------|----------------------|
| 7133 | Channel | UINT16 | Analog input channel |
| 7134 | Minimum | CUR16 | Current (minimum) |
| 7135 | Maximum | CUR16 | Current (maximum) |
| 7190 | Modbus Ctrl | UINT16 | Current |

***See Appendix A for details on data Types**

Channel

The *Channel* register selects the analog input to be used for monitoring the current command. It can also be set to be controlled via Modbus address 7190

Minimum

Maximum

The *Minimum* and *Maximum* registers specify the target current commands corresponding to analog input's minimum and maximum values, respectively. These registers define the current command range of the analog control input.

Modbus Ctrl

The *Modbus Ctrl* register specifies the current if the Channel is set to '2'.

Velocity Override

VelocityOverride Allows the velocity of a move to be controlled via an analog input or Modbus address 7180. If a move has enabled velocity override, it's velocity will be equal to the value set times the percent of range at which the analog input or Modbus address is currently at.

Analog Torque Control Parameters Register Table

| ID | Name | Type* | Description |
|------|-------------|--------|-----------------------|
| 7185 | Channel | UINT16 | Analog input channel |
| 7186 | Minimum | INT16 | Minimum percentage |
| 7187 | Maximum | INT16 | Maximum percentage |
| 7180 | Modbus Ctrl | UINT16 | Modbus override input |

***See Appendix A for details on data Types**

Channel

The *Channel* register selects the analog input to be used for setting the velocity override. It can also be set to be controlled via Modbus address 7180

Minimum

Maximum

The *Minimum* and *Maximum* registers specify the minimum and maximum percentage that the override value can attain.

Modbus Ctrl

The *Modbus Ctrl* register specifies the override level if the Channel is set to '2'.

Digital Input Assignments

The drive is controlled through an *input event* system which is organized into input event groups. Each event group may contain up to sixteen specific events within the group. Drive control is achieved through activation of input events that are assigned to the eight hardware digital inputs of the drive. Each digital input may be individually mapped to an input event by assigning the input event group and the specific event bitmap of the input event(s) within the group that is to be activated when the digital input is activated. The input event bitmaps for each group are, for convenience, given their own data type since the maps are used for the definition of multiple registers (input event bitmaps are used for digital input assignment, direct control, and status registers).

(See Appendix B for the definition of the IEG_XXX input event group data type bitmaps.)

Digital Input Parameters Register Table

| ID | Name | Type* | Description |
|------|------------------|---------|-----------------------|
| 7000 | Input.Polarities | FLAGS | Input polarity bitmap |
| 7002 | Input1.GroupMap | IEG_XXX | Input 1 group bitmap |
| 7003 | Input1.Group | IGROUP | Input 1 group |
| 7004 | Input2.GroupMap | IEG_XXX | Input 2 group bitmap |
| 7005 | Input2.Group | IGROUP | Input 2 group |
| 7006 | Input3.GroupMap | IEG_XXX | Input 3 group bitmap |
| 7007 | Input3.Group | IGROUP | Input 3 group |
| 7008 | Input4.GroupMap | IEG_XXX | Input 4 group bitmap |
| 7009 | Input4.Group | IGROUP | Input 4 group |
| 7010 | Input5.GroupMap | IEG_XXX | Input 5 group bitmap |
| 7011 | Input5.Group | IGROUP | Input 5 group |
| 7012 | Input6.GroupMap | IEG_XXX | Input 6 group bitmap |
| 7013 | Input6.Group | IGROUP | Input 6 group |
| 7014 | Input7.GroupMap | IEG_XXX | Input 7 group bitmap |
| 7015 | Input7.Group | IGROUP | Input 7 group |
| 7016 | Input8.GroupMap | IEG_XXX | Input 8 group bitmap |
| 7017 | Input8.Group | IGROUP | Input 8 group |

*See Appendix A for details on data Types

Polarities

| | | | | | | | | IN8 | IN7 | IN6 | IN5 | IN4 | IN3 | IN2 | IN1 |
|----|----|----|----|----|----|---|---|-----|-----|-----|-----|-----|-----|-----|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

IN1

Active low Input 1 polarity

IN2

Active low Input 2 polarity

IN3

Active low Input 3 polarity

IN4

Active low Input 4 polarity

IN5

Active low Input 5 polarity

IN6

Active low Input 6 polarity

IN7

Active low Input 7 polarity

IN8

Active low Input 8 polarity

GroupMap

The *GroupMap* specifies the particular event(s) within the selected input *Group*. An active digital input will activate all specified input events. The bitmap definition for each input group data type is specified in *Appendix 2*.

Group

The group identifies the input event group for the desired input event group type as specified in the following enumeration table.

IGROUP Enumerations

| Value | Associated bitmap Type* | Description |
|-------|-------------------------|--|
| 0 | IEG_MODE | Enable, mode input events |
| 1 | IEG_MOTION | General motion input events (jog, home, dedicated move...) |
| 2 | IEG_MOVE_LEVEL | Individual move maintained (level) initiates |
| 3 | IEG_MOVE_EDGE | Individual move momentary (edge) initiates |
| 4 | IEG_MOVE_TEACH | Individual move teach position |
| 5 | IEG_MOVE_SELECT | Binary selects |
| 6 | IEG_MOVE_SWITCH | Move (feed) switches (level and edge) |

***See Appendix A for details on data Types**

Digital Output Assignments

The drive maintains status flags, organized by group, that provide information on the current internal operational status of the drive. The individual bit flags in these status words are referred to as *Output Status Events* and the state of any flag may be mapped to one of the drive's digital output or LED indicators to provide status feedback. Each output event group may contain up to sixteen specific events. The output event bitmaps for each group are, for convenience, given their own data type since the maps are used for the definition of multiple registers (output event bitmaps are used for digital output assignment, direct control, and status registers).

(See Appendix B for the definition of the *OEG_XXX* output event group data type bitmaps.)

Digital Output Parameters Register Table

| ID | Name | Type* | Description |
|------|-------------------|---------|------------------------|
| 7001 | Output.Polarities | FLAGS | Output polarity bitmap |
| 7018 | Output1.GroupMap | OEG_XXX | Output 1 group bitmap |
| 7019 | Output1.Group | OGROUP | Output 1 group |
| 7020 | Output2.GroupMap | OEG_XXX | Output 2 group bitmap |
| 7021 | Output2.Group | OGROUP | Output 2 group |
| 7022 | Output3.GroupMap | OEG_XXX | Output 3 group bitmap |
| 7023 | Output3.Group | OGROUP | Output 3 group |
| 7024 | Output4.GroupMap | OEG_XXX | Output 4 group bitmap |
| 7025 | Output4.Group | OGROUP | Output 4 group |
| 7034 | RedLed.GroupMap | OEG_XXX | Red LED group bitmap |
| 7035 | RedLed.Group | OGROUP | Red LED group |
| 7036 | Grn.GroupMap | OEG_XXX | Grn LED group bitmap |
| 7037 | Grn2.Group | OGROUP | Grn LED group |
| 7040 | Yel1.GroupMap | OEG_XXX | Yel1 LED group bitmap |
| 7041 | Yel1.Group | OGROUP | Yel1 LED group |
| 7042 | Yel2.GroupMap | OEG_XXX | Yel2 LED group bitmap |
| 7043 | Yel2.Group | OGROUP | Yel2 LED group |

*See Appendix A for details on data Types

Polarities

The polarity flags are used to select the active state of the hardware output.

| | | | YEL2 | YEL1 | | GRN | RED | | | | | OUT4 | OUT3 | OUT2 | OUT1 |
|----|----|----|------|------|----|-----|-----|---|---|---|---|------|------|------|------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

OUT1

Active low Output 1 polarity

OUT2

Active low Output 2 polarity

OUT3

Active low Output 3 polarity

OUT4

Active low Output 4 polarity

RED

Active low Red LED polarity

GRN

Active low Green LED polarity

YEL1

Active low Yellow 1 LED polarity

YEL2

Active low Yellow 2 LED polarity

GroupMap

The *GroupMap* specifies the particular event(s) within the selected output event group. The output will be active when any specified bit of the *Group* is active.

Group

The group identifies the output event group for the desired output event group type as specified in the following enumeration table.

OGROUP Enumerations

| Value | Associated bitmap Type* | Description |
|-------|-------------------------|---------------------------------------|
| 0 | OEG_STATUS | General drive status output events |
| 1 | OEG_MOTION | General motion status output events |
| 2 | OEG_CONTROL | Internal control status output events |
| 3 | OEG_MOVE_ACTIVE | Active move status output events |
| 4 | OEG_MOVE_IN_POSITION | Move in-position status output events |

***See Appendix A for details on data Types**

Analog Input Channel Parameters Register Table

| CH 1 ID | CH 2 ID | Name | Type* | Description |
|---------|---------|---------------|--------|--------------------------------|
| 7200 | 7230 | Options | FLAGS | Options |
| 7201 | 7231 | Bandwidth | UINT16 | Filter bandwidth |
| 7202 | 7232 | Mode1UserLow | INT32 | Mode 1 user low calibration |
| 7204 | 7234 | Mode1UserHigh | INT32 | Mode 1 user high calibration |
| 7206 | 7236 | Mode1AdcLow | INT32 | Mode 1 ADC low calibration |
| 7208 | 7238 | Mode1AdcHigh | INT32 | Mode 1 ADC high calibration |
| 7210 | 7240 | Mode2UserLow | INT32 | Mode 2 user low calibration |
| 7212 | 7242 | Mode2UserHigh | INT32 | Mode 2 user high calibration |
| 7214 | 7244 | Mode2AdcLow | INT32 | Mode 2 ADC low calibration |
| 7216 | 7246 | Mode2AdcHigh | INT32 | Mode 2 ADC high calibration |
| 7218 | 7248 | RangeMimimum | INT32 | Minimum value of useable range |
| 7220 | 7250 | RangeMaximum | INT32 | Maximum value of useable range |
| 7222 | 7252 | FaultTripLow | INT32 | Low fault trip value |
| 7224 | 7254 | FaultTripHigh | INT32 | High fault trip value |

*See Appendix A for details on data Types

Options

| | | | | | | | | | | | | HFLT | LFLT | ORDER2 | MODE2 |
|----|----|----|----|----|----|---|---|---|---|---|---|------|------|--------|-------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

MODE2

The *MODE2* option selects the Mode2 calibration values to be used at runtime when calculating the analog input value. Some analog input channels may be fed from two physically different hardware inputs with different offsets and scales. This option allows both hardware inputs to be calibrated on a single input channel.

ORDER2

If *ORDER2* is set, the drive will filter the input value using a second order filter algorithm. If *ORDER2* is not set a first order filtering algorithm is used. A second order filter will usually be more responsive but may also lead to 'ringing'. A first order filter may settle to a quieter final value but will be less responsive, settle to its final value at a slower rate, and have trouble actually reaching the exact input value as bandwidth is reduced.

LFLT

The *LFLT* flag enables low range fault checking. A *LOSS OF SIGNAL* fault will be generated if the value of the input variable falls below the level specified by the *RangeMinimum* parameter (below).

HFLT

The *HFLT* flag enables high range fault checking. A *LOSS OF SIGNAL* fault will be generated if the value of the input variable rises above the level specified by the *RangeMaximum* parameter (below).

Bandwidth

The *Bandwidth* register sets the signal tracking frequency of the digital filter used to smooth the analog input signal. The value is a fixed point 8.8 number specifying the signal tracking frequency in Hertz.

Mode1UserLow
Mode1UserHigh
Mode1AdcLow
Mode1AdcHigh
Mode2UserLow
Mode2UserHigh
Mode2AdcLow
Mode2AdcHigh

RangeMinimum
RangeMaximum

FaultTripLow
FaultTripHigh

Analog Output Channel Parameters Register Table

| CH 1 ID | CH 2 ID | Name | Type* | Description |
|---------|---------|---------------|--------|-----------------------------|
| 7400 | 7416 | Options | FLAGS | Options |
| 7401 | 7417 | Bandwidth | UINT16 | Filter bandwidth |
| 7402 | 7418 | VariableID | UINT16 | Output variable ID |
| 7403 | 7419 | VariableFlags | UINT16 | Output variable flags |
| 7404 | 7420 | CalLow | UINT16 | DAC low calibration offset |
| 7405 | 7421 | CalHigh | UINT16 | DAC high calibration offset |
| 7406 | 7422 | VarMinimum | INT32 | Minimum variable value |
| 7408 | 7424 | VarMaximum | INT32 | Maximum variable value |

*See Appendix A for details on data Types

Options

The *Options* register selects various options available for the analog output channel.

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---------------|---|---|
| | | | | | | | | | | | | | ORDER2 | | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

ORDER2

If *ORDER2* is set, the drive will filter the output value using a second order filter algorithm. If *ORDER2* is not set a first order filtering algorithm is used. A second order filter will usually be more responsive but may also lead to 'ringing'. A first order filter may settle to a quieter final value but will be less responsive, settle to its final value at a slower rate, and have trouble actually reaching the true end point values as bandwidth is reduced.

Bandwidth

The *Bandwidth* register specifies the bandwidth, in Hertz, of the filter used to smooth the analog output signal..

VariableID

The *VariableID* register specifies the *MODBUS* identifier of the variable whose value is to be monitored on the analog output channel.

VariableFlags

The *VariableFlags* registers provide additional information about the type of variable being monitored on the analog output channel.

| | | | | | | | | | | | | | | | |
|-----------------|----|----|----|----|----|---|---|---|---|---|---|---|---|----------|---|
| reserved | | | | | | | | | | | | | | D | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

D

The *D* flag indicates that the variable is a double word (32 bit) variable. The *VariableID* register specifies the starting register of the value to monitor. If the *D* flag is set, the starting register is assumed to be the low word of a 32-bit value. If the *D* flag is not set, the starting register is assumed to be a 16-bit value.

CalLow

DAC low calibration offset

CalHigh

DAC high calibration offset

VarMinimum

VarMaximum

Minimum and maximum variable values defining the range over which the analog output is scaled.

Mapped Parameters

The mapped parameter register tables provide a method for user to organize the *MODBUS* registers that it needs to read and write into contiguous blocks. The *MappedRead* and *MappedWrite* parameter registers each contain a list *MODBUS* register identifiers. At run time, a *MODBUS Master* may use the *MODBUS* read/write multiple register commands to read or write contiguous blocks of data from the *MappedReadValue* and *MappedWriteValue* tables. These value tables do hold actual data values but refer instead to the values stored at the registers specified in the corresponding *MappedRead* or *MappedWrite* parameter tables. Considerable runtime communications overhead is saved since the individual registers do not have to be individually read or written single *MODBUS* commands.

Mapped Register Parameter Table

| ID | Name | Type* | Size | RunTime Table | Description |
|------|-------------|--------|------|------------------|---|
| 8000 | MappedRead | UINT16 | 100 | MappedReadValue | Mapped read <i>MODBUS</i> register IDs [0..99] |
| 8200 | MappedWrite | UINT16 | 100 | MappedWriteValue | Mapped write <i>MODBUS</i> register IDs [0..99] |

***See Appendix A for details on data Types**

MappedRead

Each element of the *MappedRead* table specifies the *MODBUS* identifier of the register that will be indirectly read or written through the corresponding element of the *MappedReadValue* table. Unused table values should be set to zero.

MappedWrite

Each element of the *MappedWrite* table specifies the *MODBUS* identifier of the register that will be indirectly read or written through the corresponding element of the *MappedWriteValue* table. Unused table values should be set to zero.

Mapped Register Value Table

| ID | Name | Type* | Size | Description |
|------|------------------|--------|------|---|
| 8400 | MappedReadValue | UINT16 | 100 | Runtime indirect values for MappedRead IDs |
| 8600 | MappedWriteValue | UINT16 | 100 | Runtime indirect values for MappedWrite IDs |

***See Appendix A for details on data Types**

MappedReadValue

Reading or writing values in the *MappedReadValue* table will read or write the register specified in the corresponding element of the *MappedRead* parameter register table. If the *MappedRead* parameter value (i.e. register id) is zero, a read will return a zero and a write will have no effect.

MappedWriteValue

Reading or writing values in the *MappedWriteValue* table will read or write the register specified in the corresponding element of the *MappedWrite* parameter register table. If the *MappedWrite* parameter value (i.e. register id) is zero, a read will return a zero and a write will have no effect.

The *MappedRead/MappedWrite* and *MappedReadValue/MappedWriteValue* tables work in an identical manner. There is no actual requirement that the *read* tables be used only for reading registers and the *write* tables for writing registers. A *MODBUS Master* is free to read or write from either table and may read and write from the same table. Any starting register and number of multiple registers to be read or written may be specified so long as the range of registers is within the table being used.

An *EtherNet/IP MODBUS Master* uses the read tables only for reading, the write tables only for writing, and will read or write the full table with a single *MODBUS* command.

Factory Parameters

Factory parameters are stored as a block in non-volatile memory. The block contains a CRC (Cyclic Redundancy Checksum) word to guarantee data integrity. At power-up, the factory parameter block is validated and copied to its runtime location in RAM where all parameters are available for both reading and writing through their individual MODBUS identifiers.

Factory Identification Parameters

Factory Identification Parameters Register Table

| ID | Name | Type* | Description |
|------|--------------|-------|-----------------------|
| 9000 | PartNumber | STR16 | Factory part number |
| 9016 | SerialNumber | STR16 | Factory serial number |

*See Appendix A for details on data Types

PartNumber

The *PartNumber* register specifies the part number assigned to the drive by the factory during commissioning.

SerialNumber

The *SerialNumber* register specifies the serial number assigned to the drive by the factory during commissioning.

Factory Actuator Parameters

Factory Actuator Parameters Register Table

| ID | Name | Type* | Description |
|------|----------------|--------|-----------------------------------|
| 9100 | Model | STR16 | Model name |
| 9116 | Options | FLAGS | Option flags |
| 9117 | EcyclesPerRev | UINT16 | Poles / 2 |
| 9118 | R | UINT16 | Resistance [8.8 ohms L-L] |
| 9119 | L | UINT16 | Inductance [8.8 mH L-L] |
| 9120 | J | UINT32 | Inertia [0.32 kg-m ²] |
| 9122 | KT | UINT16 | KT [6.10 Nm/AMP] |
| 9123 | FeedbackDevice | ENUM | Position feedback device type |
| 9124 | StepsPerRev | UINT32 | Encoder steps/rev |

*See Appendix A for details on data Types

Model

The *Model* specifies the factory name for the actuator.

Options

The Options register is used to enable various actuator options as specified in the word bitmap.

| | | | | | | | | | | | | | EAB | PTBL | TEMP |
|----|----|----|----|----|----|---|---|---|---|---|---|---|-----|------|------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

EAB

Allows position feedback encoder wiring flexibility by performing an internal signal swap of the encoder A dn B channels.

PTBL

Enables use of the factory parameters position correction table. This flag will normally be enabled when the drive uses linear Hall sensors for position feedback.

TEMP

The *TEMP* option indicates that the actuator utilizes a thermistor for temperature fault detection. If enabled, the drive will monitor the actuator's temperature for a fault (or warning) condition using the factory actuator temperature limit. If disabled, the fault input from the actuator is monitored a digital fault input and the factory actuator temperature trip level parameter is ignored.

EcyclesPerRev

EcyclesPerRev specifies the electrical cycles per actuator revolution, or one-half the number of motor electrical poles.

R

R specifies the line-to-line winding resistance in fixed-point units of 8.8 ohms.

L

L specifies the line-to-line winding inductance in fixed-point units of 8.8 milli-henrys.

J

J specifies the actuator's rotor inertia in fixed-point units of 0.32 kg-m².

KT

KT specifies the actuator's torque constant in fixed-point units of 6.10 Nm / amp.

FeedbackDevice

FeedbackDevice is an enumerated value specifying the type of the actuator's position feedback device and should be one of the following values:

0 - Analog Hall

The *Analog Hall* feedback device uses magnetic linear Hall analog inputs to generate pseudo-sinusoidal analog signals in quadrature from which a position angle may be determined.

1 - Analog Hall Absolute

The *Analog Hall Absolute* uses the same angular feedback method as the Analog Hall, but also incorporates battery backed monitoring functionality to track position change while the drive is powered down so that the absolute position of the drive is always tracked.

2 - Incremental Encoder

The *Incremental Encoder* position feedback device utilizes an incremental encoder with UVW commutation tracks.

StepsPerRev

StepsPerRev specifies the steps per actuator revolution from an encoder position device. *StepsPerRev* is used only if the *FeedbackDevice* has been selected to Encoder.

CAUTION

StepsPerRev is specified in steps/rev, NOT encoder lines. For standard quadrature encoding, steps/rev = 4 * encoder lines

Factory Limits Parameters

Factory Limits Parameters Register Table

| ID | Name | Type* | Description |
|------|-----------------------|---------|---------------------------------------|
| 9200 | LowVoltageTripLevel | UVOLT16 | Low voltage fault trip level |
| 9201 | HighVoltageTripLevel | UVOLT16 | High voltage fault trip level |
| 9202 | BoardTempTripLevel | BTMP16 | PCB temperature trip level |
| 9203 | Itrip | UCUR16 | Current fault trip level |
| 9204 | Ipeak | UCUR16 | Peak command current |
| 9205 | Icontinuous | UCUR16 | Continuous current rating |
| 9206 | IcTimeConstant | UINT16 | Continuous current time constant |
| 9209 | ActuatorTempTripLevel | ATMP16 | Actuator temperature fault trip level |
| 9210 | PwmModulation | INT16 | PWM modulation factor |
| 9211 | ShuntHigh | UINT16 | High shunt level (shunt ON) |
| 9212 | ShuntLow | UINT16 | Low shunt level (shunt OFF) |

*See Appendix A for details on data Types

LowVoltageTripLevel

HighVoltageTripLevel

BoardTempTripLevel

Itrip

Ipeak

Icontinuous

IcTimeConstant

ActuatorTempTripLevel

PwmModulation

ShuntHigh

ShuntLow

Factory Calibration Parameters

Factory Calibration Parameters Register Table

| ID | Name | Type* | Description |
|------|--------------------|--------|---|
| 9300 | Options | FLAGS | Options / option board flags |
| 9301 | VbusScale | INT16 | DC Bus voltage scale |
| 9302 | BoardTempOffset | INT16 | PCB temperature offset |
| 9303 | BoardTempScale | INT16 | PCB temperature scale |
| 9304 | PsinelnZero | INT16 | Linear Hall sine zero offset |
| 9305 | PsinelnScale | INT16 | Linear Hall sine scale |
| 9306 | PcosineInZero | INT16 | Linear Hall cosine zero offset |
| 9307 | PcosineInScale | INT16 | Linear Hall cosine scale |
| 9308 | RphaseOffset | INT16 | R phase current sensor offset |
| 9309 | RphaseScale | INT16 | R phase current sensor scale |
| 9310 | SphaseOffset | INT16 | S phase current sensor offset |
| 9311 | SphaseScale | INT16 | S phase current sensor scale |
| 9315 | Eoffset | INT16 | Electrical angle offset |
| 9320 | BrakeReleaseDelay | UINT16 | Brake release delay [0.01s] |
| 9321 | BrakeEngageDelay | UINT16 | Brake engage delay [0.01s] |
| 9323 | TharmonicMag | INT16 | Torque harmonic magnitude [2..14AMPS] |
| 9328 | ActuatorTempOffset | INT16 | Actuator temperature offset [13.3 DEG] |
| 9329 | ActuatorTempScale | INT16 | Actuator temperature scale [13.3 DEG/FULLSCALE] |

*See Appendix A for details on data Types

Options

The *Options* register is used to enable various factory options as specified by the following table.

| IA4 | SCIB | | | | | | | | | | | | TH | | |
|------------|-------------|----|----|----|----|---|---|---|---|---|---|---|-----------|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

IA4

Analog I/O option board.

SCIB

Modbus serial communications enabled on on SCI-B.

TH

Torque harmonics enable

VbusScale

BoardTempOffset

BoardTempScale

PsinelnZero

PsinelnScale

PcosinelnZero

PcosinglnScale

RphaseOffset

RphaseScale

SphaseOffset

SphaseScale

Eoffset

BrakeReleaseDelay

BrakeEngageDelay

TharmonicMag

ActuatorTempOffset

ActuatorTempScale

Factory Tuning Parameters

Factory Tuning Parameters Register Table

| ID | Name | Type* | Description |
|------|-------------|--------|-----------------------------------|
| 9400 | Options | FLAGS | Option flags |
| 9401 | HallBW | UINT16 | Position angle tracking bandwidth |
| 9402 | HallDamping | UINT16 | Position angle tracking damping |
| 9403 | IloopBW | UINT16 | Current loop bandwidth [HZ] |
| 9405 | VbusBW | UINT16 | Bus voltage filter bandwidth [HZ] |

*See Appendix A for details on data Types

Options

The *Options* register enables various internal tuning and algorithm options as specified by the following table.

| | | | | | | | | | | | | | | SV | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|----|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

SV

Enables use of a *space vector* voltage control algorithm in the current loop as opposed to pure sinusoidal voltage *PWM* commands to the actuator phases. The space vector algorithm allows for more efficient use of the available DC bus voltage, resulting in more available torque at any given speed. The *space vector* option is normally enabled.

HallBW

The bandwidth of the position tracking converter in rad/s.

HallDamping

IloopBW

The bandwidth of the current loop in HZ.

VbusBW

The bandwidth of the DC Bus filter in HZ.

Factory Position Correction Table

Factory Position Correction Register Table

| ID | Name | Type* | Description |
|------|--------------------|-----------|-----------------------------------|
| 9500 | PosCorrectionTable | INT16[64] | Position correction factors table |

*See Appendix A for details on data Types

Factory Commutation Table

The commutation table is set at the factory for an actuator using encoder position feedback. The encoder device contains UVW commutation tracks. The tracks are usually Grey scale encoded (only one bit can change at a time). The table contains the angle, in electrical degrees, for the center of the UVW pattern and enables the drive to establish the initial electrical within +/- 30 degrees at startup (the exact angle is not known until a change is observed to the UVW pattern). Illegal table values (normally 000 and 111) should have the high bit (Bit 15) set in the angle.

Factory Commutation Register Table

| ID | Name | Type* | UVW Electric Angle |
|------|------|--------|---------------------|
| 9600 | 0 | UINT16 | 0 0 0 pattern angle |
| 9601 | 1 | UINT16 | 0 0 1 pattern angle |
| 9602 | 2 | UINT16 | 0 1 0 pattern angle |
| 9603 | 3 | UINT16 | 0 1 1 pattern angle |
| 9604 | 4 | UINT16 | 1 0 0 pattern angle |
| 9605 | 5 | UINT16 | 1 0 1 pattern angle |
| 9606 | 6 | UINT16 | 1 1 0 pattern angle |
| 9607 | 7 | UINT16 | 1 1 1 pattern angle |

***See Appendix A for details on data Types**

Factory Communication Parameters

The serial channel used internally for communications with the Ethernet/IP Modbus Master uses the *MODBUS* parameters shown in the table below. The parameter descriptions are identical to those used for the user Modbus parameter registers.

Factory Communication Parameters Register Table

| ID | Name | Type* | Description |
|------|---------|--------|---|
| 9700 | Flags | FLAGS | Modbus Serial Channel B flags |
| 9701 | AxisId | UINT16 | Modbus Serial Channel B axis identifier |
| 9702 | Baud | UINT16 | Modbus Serial Channel B baud identifier |
| 9703 | RxDelay | UINT16 | Modbus Serial Channel B extra RX delay |
| 9704 | TxDelay | UINT16 | Modbus Serial Channel B extra TX delay |

***See Appendix A for details on data Types**

Status Registers

All status registers are read-only (*MODBUS* input registers) and provide feedback information on the runtime operation of the drive. Status registers normally exist in *RAM* and their values are not saved in non-volatile memory between drive power-ups.

System Status Registers

This section describes general status registers used to monitoring overall drive operational status.

System Status Register Table

| ID | Name | Type* | Description |
|----|--------------|---------|--|
| 4 | Disables | FLAGS | Drive disabling sources |
| 5 | Faults | FAULT | All active faults |
| 6 | HardFaults | FAULT | Active disabling faults |
| 7 | SoftFaults | FAULT | Active non-disabling faults |
| 8 | HallBattery | UVOLT16 | Absolute Hall board battery voltage [11.5 V] |
| 10 | BoardTemp | BTMP32 | PCB temperature [11.21 DEG C] |
| 14 | ActuatorTemp | ATMP32 | Actuator temperature [13.19 DEG C] |
| 24 | Faults32 | FAULT | All active faults (32 faults) |
| 26 | HardFaults32 | FAULT | Active disabling faults (32 faults) |
| 28 | SoftFaults32 | FAULT | Active non-disabling faults (32 faults) |

Disables

The Disables status register is a bitmapped value indicating all currently active disabling sources in the drive. When all disabling sources are removed (register value is zero), the drive will become enabled.

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|------------|
| | | | | | | | | | | | | | | | LVW |
| 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |

| | | | | | | | | | | | | | | | |
|------------|-----------|--------------|--------------|----|--------------|---|---|---|---|---|-------------|--------------|------------|-------------|--------------|
| INT | PU | FLASH | RESET | | COMMS | | | | | | MODE | EMOVE | FLT | HOST | HWENA |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

HWENA

The drive cannot enable due to an inactive *Enable* input event. This disabling source will clear on the rising edge of a *Momentary Enable* input event, an active *Maintained Enable* input event, or an active *AE (Auto Enable)* flag in *Configuration.Options*.

HOST

The drive cannot enable while the *Host.Disables* register is non-zero.

FLT

The drive is disabled due to an active *FAULT* that has been selected as 'hard' fault which disables the drive.

EMOVE

The drive has been disabled upon completion of a *Dedicated Move* with the *DMD (Dedicated Move Disable)* option selected in *Configuration.Options*. Disabling upon completion of a *Dedicated Move* is not considered a fault and the *EMOVE* flag is not cleared on the rising edge of the *Reset Faults* input event but instead is cleared only on the rising edge of *ENABLE*, leaving the *EMOVE* flag active as an indicator of why the drive disabled.

MODE

The drive's currently active *Command Mode* is the *Disabled* mode. The *MODE* flag will clear automatically when the drive's command mode is anything other than the *Disabled* mode.

COMMS

The drive has lost communications after it had been established. This flag does NOT automatically clear if the communications is reestablished. This flag can be disabled from the *Comms Faults* tab in the *System Setup* page.

RESET

The drive is temporarily disabled internally while restarting from a *Restart Drive* system command. The *RFESSET* flag will not be active during normal operation.

FLASH

The drive is disabled internally while firmware is being upgraded. The *FLASH* flag will not be active during normal operation.

PU

The drive is temporarily disabled internally during startup initialization. This disabling indicator is used internally at startup to keep the drive disabled until internal filtered values have stabilized and the drive is ready for normal operation. The *PU* flag will not be active during normal operation.

INT

The drive is disabled for unspecified internal reasons. The *INT* flag will not be active during normal operation.

Faults and Faults2

The *Faults/Faults2* registers latches all fault conditions observed whether or not the faults have been selected to generate hard or soft faults. Flags set in this register indicate that the criteria required for the fault condition has been satisfied. The *Faults* register is reset to zero on the rising edge of the *Enable Momentary*, *Enable Maintained*, or *Reset Faults* input events.

HardFaults and HardFaults2

The *HardFaults/Faults2* registers latches all fault conditions that have been selected in *FaultDisables/FaultsDisables2* to disable the drive. The *Faults/Faults2* registers are reset to zero on the rising edge of the *Enable Momentary*, *Enable Maintained*, or *Reset Faults* input events

SoftFaults and SoftFaults2

The *SoftFaults/SoftFaults2* registers indicates all fault conditions that are currently active and have been selected in the *FaultWarnings* register. The *Fault Warning* output event will be active while any flag is active in *SoftFaults/SoftFaults2*. *SoftFaults/SoftFaults2* flags are dynamic and will reset automatically when the fault condition is removed.

HallBattery

The *HallBattery* register monitors the battery supply voltage from the Absolute Hall board. The Absolute Hall board's nominal voltage is 3.7V full-scale. A value of less than 2.8V will set the *Hall Battery* fault flag (*HB*) flag in the *Faults* register. The register is updated only when the actuator's position feedback device is selected to be Absolute Hall feedback – for other position feedback devices the voltage will always be zero and the *Hall Battery* fault flag is not updated.

BoardTemp

The *BoardTemp* register monitors the *PCB (Printed Circuit Board)* temperature. A value greater than *BoardTempTripLevel* in the *Factory Limits Register Table* will set the *Board Temperature* fault flag (*BT*) in the *Faults* register.

ActuatorTemp

The *ActuatorTemp* register monitors actuator temperature from the actuator's temperature fault input. A value greater than *ActuatorTempTripLevel* in the *Factory Limits Register Table* will set the *Actuator Temperature* fault flag (*AT*) in the *Faults* register. *ActuatorTemp* is updated only when the temperature fault input from the actuator is configured as a thermistor input. When the actuator's temperature fault input is configured as a digital switch input, the *ActuatorTemp* register will always be zero and the *Actuator Temperature* fault flag will be updated from the status of the digital switch input.

BoardTemp and ActuatorTemp are 32-bit filtered values. In general, only the high word of these registers (ID + 1) will need to be monitored - the low word provides extra resolution used internally by the filtering process.

Digital Input Status Register Table

| ID | Name | Type* | Description |
|-----|------------------------|-----------------|--|
| 100 | Inputs | FLAGS | Active input status |
| 102 | HwInputs | FLAGS | Hardware input status (before inhibits/polarity) |
| 110 | InputEvents.Mode | IEG_MODE | Mode input events |
| 111 | InputEvents.Motion | IEG_MOTION | Motion input events |
| 112 | InputEvents.MoveLevel | IEG_MOVE_LEVEL | Move Maintained input events |
| 113 | InputEvents.MoveEdge | IEG_MOVE_EDGE | Move Momentary input events |
| 114 | InputEvents.MoveTeach | IEG_MOVE_TEACH | Move Teach Position input events |
| 115 | InputEvents.MoveSelect | IEG_MOVE_SELECT | Binary Select input events |
| 116 | InputEvents.MoveSwitch | IEG_MOVE_SWITCH | Move Switches input events |
| 118 | LatchedInputEvents[8] | IEG_x | Latched input event status |
| 126 | RisingInputEvents[8] | IEG_x | Rising edge input event status |
| 134 | FallingInputEvents[8] | IEG_x | Falling edge input event status |

***See Appendix A for details on data Types**

Inputs

The *Inputs* register indicates the active state of the digital inputs. The active input state is the logical exclusive or of the *HwInputs* register (below) and the *Inputs.Polarity* parameter register.

HwInputs

The *HwInputs* register reflects the hardware status of the digital inputs.

InputEvents.x

The input event registers reflect the active state of all input event groups. Input events are activated when a digital input assigned to the event is active in the *Inputs* register (if the input is not inhibited by a host controller) or when the event is directly set active by the host through the host input event registers.

LatchedInputEvents

RisingInputEvents

FallingInputEvents

These registers are used internally to track edge sensitivity of the inputs and are updated during each background scan of the controller.

Digital Output Status Register Table

| ID | Name | Type* | Description |
|-----|-----------------------------|-----------------|--|
| 101 | Outputs | FLAGS | Active output status |
| 103 | HwOutputs | FLAGS | Hardware output status (after inhibits/polarity) |
| 104 | OutputEvents.Status | OEG_STATUS | Drive Status output events |
| 105 | OutputEvents.Motion | OEG_MOTION | Motion output events |
| 106 | OutputEvents.Control | OEG_CONTROL | Control output events |
| 107 | OutputEvents.MoveActive | OEG_MOVE_ACTIVE | Move Active output events |
| 108 | OutputEvents.MoveInPosition | OEG_MOVE_IN_POS | Move In-Position output events |

*See Appendix A for details on data Types

Outputs

The *Outputs* register reflects the state of any output status events assigned to the hardware outputs and LEDs.

HwOutputs

Unless an output is inhibited by a host controller, the HwOutputs reflects the logical exclusive or of the Outputs register and the Outputs.Polarity parameter register combined with any direct outputs set by a host controller in Host.Outputs. When an output is inhibited, only the contribution from Host.Outputs will be reflected. The HwOutputs word directly maps to the actual state of the hardware digital outputs and LEDs.

OutputEvents.x

The output event registers reflect the active state of all output status event groups. Digital outputs assigned to an output status event will be active in the Outputs register when the associated output status event is active.

Analog Input Status Registers

The registers in the *Analog Input Status Registers Table* provide runtime information on the state of *Analog Input Channel 1* and *Analog Input Channel 2*.

Analog Input Status Registers Table

| ID | | Name | Type* | Description |
|------|------|---------------|--------|---|
| CH 1 | CH 2 | | | |
| 221 | 241 | Instantaneous | UINT16 | Unfiltered ADC input (0x0000..0xFFF0) |
| 222 | 242 | Filtered | INT32 | Filtered ADC input (0..1) [2.30] |
| 224 | 244 | UserFiltered | INT32 | Filtered input [6.26 user units] |
| 226 | 246 | UseableRange | INT32 | Fraction of useable range (0..1) [2.30] |
| 228 | 248 | dydx | INT32 | dy/dx scale factor [10.22] |
| 230 | 250 | B | INT32 | y-axis intercept offset [6.26 user units] |
| 232 | 252 | RangeMinimum | INT32 | Minimum useable range [2.30 ADC] |
| 234 | 254 | RangeMaximum | INT32 | Maximum useable range [2.30 ADC] |

*See Appendix A for details on data Types

Instantaneous

The *Instantaneous* register provides the unfiltered most recent value from the ADC.

Filtered

The *Filtered* register provides the raw filtered value from the ADC. The value is a fixed-point 2.30 value in the range 0 to 1.

UserFiltered

The *UserFiltered* register scales the raw *Filtered* value (above) in the user range specified by the *RangeMinimum* and *RangeMaximum* registers.

UseableRange

dydx

b

For runtime efficiency, internal scale and offset values are calculated by the controller to convert runtime analog input values to user units from the two-point calibration values. The *dydx* (scale) and *b* (*offset*) values are calculated at start-up and whenever the analog input parameter values are modified.

RangeMinimum

RangeMaximum

The *RangeMinimum* and *RangeMaximum* registers specify the minimum and maximum values, respectively, that the final *UserFiltered* input value will be scaled into. The values are fixed-point 2.30 values.

Analog Output Status Registers

The registers in the *Analog Output Status Registers Table* provide runtime information on the state of the values being monitored on *Analog Output Channel 1* and *Analog Output Channel 2*.

Analog Output Status Registers Table

| ID | | Name | Type* | Description |
|------|------|----------|--------|-----------------------------|
| CH 1 | CH 2 | | | |
| 700 | 704 | Filtered | INT32 | Filtered output variable |
| 702 | 706 | RawDAC | UINT16 | DAC output [0x0000..0xFFFF] |
| 703 | 707 | Fraction | UINT16 | Fraction of variable range |

*See Appendix A for details on data Types

Filtered

The register(s) being monitored on the output are filtered in the 32-bit *Filtered* register based on the filter parameters set for the analog channel. If monitoring a single (16-bit) register, the 32-bit filtered value will be left justified.

RawDAC

RawDAC uses the analog output's calibration values to scale the calculated Fraction into the range 0x0000 to 0xFFFF using the basic formula: $RawDAC = calLow + ((0xFFFF - calHigh) - calLow) * Fraction / 0x8000$. A *RawDAC* value of 0x0000 maps to the minimum *DAC* output and a value of 0xFFFF maps to the maximum *DAC* output. (The actual value written to the *DAC* will depend on the hardware specific *DAC* circuitry and resolution used for the particular analog output channel.

Fraction

Fraction uses the minimum and maximum values set-up for the analog output channel to scale the *Filtered* value into the range 0x0000 to 0x8000 using the basic formula: $Fraction = (Filtered - minimum) / (maximum - minimum)$.

Analog Command Status Registers

The *Analog Command Status Registers Table* specifies the registers that monitor the analog input commands for the *Analog Position*, *Analog Velocity*, and *Analog Torque* operating modes. These status registers are updated at a 1 millisecond rate regardless of the drive's operating mode. The analog input channel source and operational range of the analog command signals are set-up in the *Analog Motion Control* parameters section.

Analog Command Status Registers Table

| ID | Name | Type* | Description |
|-----|----------------------|-------|------------------------------|
| 200 | AnalogPositionTarget | POS32 | Analog Position Mode command |
| 202 | AnalogVelocityTarget | VEL32 | Analog Velocity Mode command |
| 204 | AnalogCurrentTarget | CUR32 | Analog Current Mode command |

*See Appendix A for details on data Types

AnalogPositionTarget

Position command to the position loop while the drive's operating mode is Analog Position Mode.

AnalogVelocityTarget

Velocity command to the position loop while the drive's operating mode is Analog Velocity Mode.

AnalogCurrentTarget

Current (torque) command to the current loop while the drive's operating mode is Analog Current Mode.

Position and Velocity Status Registers

The status registers in this section provide position and velocity command, feedback, and error status.

| ID | Name | Type* | Description |
|-----|-----------|-------|---------------------------|
| 344 | Vfeedback | VEL32 | Feedback velocity |
| 346 | Vcommand | VEL32 | Command velocity |
| 348 | Verror | VEL32 | Velocity error |
| 350 | VerrorMin | VEL32 | Minimum velocity error |
| 352 | VerrorMax | VEL32 | Maximum velocity error |
| 356 | Vdisplay | VEL32 | Filtered display velocity |
| 378 | Pfeedback | POS32 | Feedback position |
| 380 | Pcommand | POS32 | Command position |
| 382 | Perror | POS32 | Position error |
| 384 | PerrorMin | POS32 | Minimum position error |
| 386 | PerrorMax | POS32 | Maximum position error |

*See Appendix A for details on data Types

Vfeedback

The *Vfeedback* register monitors the feedback velocity.

Vcommand

The *Vcommand* register monitors the command velocity.

Verror

The *Verror* register monitors the velocity error and is equal to the difference between *Vcommand* and *Vfeedback*.

VerrorMin

VerrorMax

VerrorMin and *VerrorMax* monitor the minimum and maximum values of *Verror*, respectively, that have been observed since diagnostics values were last reset.

Pfeedback

The *Pfeedback* register monitors the absolute feedback position.

Pcommand

The *Pcommand* register monitors the absolute command position.

Perror

The *Perror* register monitors the positional following error and is equal to the difference between *Pcommand* and *Pfeedback*.

PerrorMin

PerrorMax

PerrorMin and *PerrorMax* monitor the minimum and maximum values of *Perror*, respectively, that have been observed since diagnostics values were last reset.

The registers in this section provide feedback on the state of the current loop and *PWM* phase voltages.

| ID | Name | Type* | Description |
|-----|-------------|--------|---------------------------|
| 502 | Eangle | REV32 | Electrical angle |
| 504 | Esine | INT32 | Sin(Eangle) |
| 506 | Ecosine | INT32 | Cos(Eangle) |
| 508 | IR | CUR32 | R phase current feedback |
| 510 | IS | CUR32 | S phase current feedback |
| 512 | IT | CUR32 | T phase current feedback |
| 520 | IqFeedback | CUR32 | Q (torque) leg current |
| 526 | Imagnitude | CUR32 | Current vector magnitude |
| 564 | Icontinuous | UCUR32 | Continuous current |
| 566 | Idisplay | CUR32 | Filtered display current |
| 568 | Vbusl | VOLT32 | Instantaneous bus voltage |
| 570 | Vbus | VOLT32 | Filtered bus voltage |

*See **Appendix A** for details on data Types

Eangle

The *Eangle* register monitors the electrical being used for commutation.

Esine

Ecosine

The *Esine* and *Ecosine* registers monitor the sine and cosine of the electrical angle, respectively, in 2.30 fixed point units.

IR

IS

IT

The *IR*, *IS*, and *IT* registers monitor the actuator's phase current feedbacks.

IqFeedback

The *IqFeedback* register monitors the current (torque) leg of the current feedback vector.

Imagnitude

The *Imagnitude* register monitors the value of the overall current vector magnitude.

Icontinuous

The *Icontinuous* register monitors the value of the average current being used by the drive.

Idisplay

The *Idisplay* register provides a more stable, filtered value of the *IqFeedback* which is used for display purposes.

Vbusl

The *Vbusl* register provides the unfiltered value of the most recent voltage present on the DC Bus.

Vbus

The *Vbus* register provides the filtered value of the voltage present on the DC Bus.

Command Status Registers

Registers in this section reflect the final internal command values based on the active operational command mode and command limits that are in effect.

Command Register Table

| ID | Name | Type* | Description |
|----|----------------|--------|-----------------------------------|
| 30 | SubMode | FLAGS | Active command sub-mode |
| 31 | Mode | OPMODE | Active command mode |
| 34 | PlimitMinus | POS32 | Active position limit (-) |
| 36 | PlimitPlus | POS32 | Active position limit (+) |
| 38 | PlimitVelocity | INT32 | Active position limit velocity |
| 40 | llimitMinus | CUR32 | Active current limit (-) |
| 42 | llimitPlus | CUR32 | Active current limit (+) |
| 44 | Vlimit | INT32 | Active velocity limit |
| 46 | Alimit | UACC32 | Active acceleration limit |
| 50 | Ptarget | POS32 | Active position target |
| 52 | Vtarget | INT32 | Active velocity target |
| 54 | Id | CUR32 | Direct current command |
| 56 | Iq | CUR32 | Quadrature current command |
| 58 | Vd | VOLT32 | Direct voltage command |
| 60 | Vq | VOLT32 | Direct quadrature voltage command |

*See Appendix A for details on data Types

SubMode

The *SubMode* register provides additional command mode information for the main command mode specified in the *Mode* register. Currently, *SubMode* values are used only for *Digital IO* command mode as specified by the bitmap table. For all other modes, the *SubMode* register will always be zero.

| UNHOMED | BKDLY | | | | | | | | | MOV | JOG_NEG | JOG_POS | PAUSE | STOP | |
|---------|-------|----|----|----|----|---|---|---|---|-----|---------|---------|-------|------|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

STOP

The *STOP* flag indicates the drive is holding due to a stop condition.

PAUSE

The *PAUSE* flag indicates the drive is holding due to a paused move condition.

JOG_NEG

JOG_POS

The *JOG_NEG* and *JOG_POS* flags indicate that the *JOG NEGATIVE* or *JOG POSITIVE* input events are active.

MOV

The *MOV* field encodes a currently active move.

- 0 – none
- 3 – Dedicated Move to Position active
- 4 – Home Move active
- 5 – Standard Move (0..15) active

BKDLY

The *BKDLY* flag indicates the drive is enabled but brake holding delay is active.

UNHOMED

The *UNHOMED* flag indicates the drive is enabled but the absolute position reference frame must be defined before normal operation can occur.

Mode

The *Mode* register specifies the currently active command operational mode.

PlimitMinus**PlimitPlus**

The *PlimitMinus* and *PlimitPlus* registers provide the values of the negative and positive position limits, respectively, that are currently in effect. These values are available whether or not either position limit is actually enabled.

IlimitMinus**IlimitPlus**

The *IlimitMinus* and *IlimitPlus* registers provide the values of the negative and positive current limits that are in effect.

Vlimit**Alimit**

The *Vlimit* and *Alimit* registers provide the values of command velocity and acceleration that are in effect.

Ptarget**Vtarget**

The *Ptarget* and *Vtarget* registers provide the position and velocity targets used for all positional control modes of operation.

Id**Iq**

The *Id* and *Iq* registers provide the direct and quadrature (torque) current commands to the current control loop. The *Id* command will always be zero for normal operational modes and is used only in the current and voltage locking modes.

Vd**Vq**

The *Vd* and *Vq* registers provide the direct and quadrature *PWM* voltage commands.

System Diagnostics Register Table

| ID | Name | Type* | Description |
|-----|---------------|--------|--|
| 576 | MaxImagnitude | UCUR32 | Maximum current vector magnitude observed |
| 578 | MaxVbus | VOLT32 | Maximum DC bus voltage observed |
| 580 | MinLoopTime | UINT32 | Minimum control loop execution time [SYSCLK] |
| 582 | MaxLoopTime | UINT32 | Maximum control loop execution time [SYSCLK] |
| 584 | AvgLoopTime | UINT32 | Average control loop execution time [SYSCLK] |
| 16 | MinScanTime | UINT32 | Minimum background scan time [SYSCLK] |
| 18 | MaxScanTime | UINT32 | Maximum background scan time [SYSCLK] |
| 20 | AvgScanTime | UINT32 | Average background scan time [SYSCLK] |

*See Appendix A for details on data Types

MaxImagnitude

MaxVbus

The current loop controller tracks the maximum current vector magnitude and DC bus voltage values observed since power-on. If the values observed exceed the maximum stress values in the *Status Log*, the *Status Log* values are updated and the *Status Log* is re-saved to non-volatile memory. The *IDIAG* control bit in the *System Command* register may be used to reset the maximum values observed and capture new data.

MinLoopTime

MaxLoopTime

AvgLoopTime

The current loop controller tracks its minimum and maximum execution times. The execution times are run through an internal single stage filter to track the average execution time. All times are tracked at the system clock rate of 100 MHz. The loop execution time also includes the time required to execute the position and velocity loop controllers. The *IDIAG* control bit in the *System Command* register may be used to reset the minimum and maximum times observed and capture new data. The drive's loop execution times are normally used internally for test and validation.

MinScanTime

MaxScanTime

AvgScanTime

The drive's background scan routine tracks its minimum and maximum execution times. The execution times are run through an internal single stage filter to track the average execution time. All times are tracked at the system clock rate of 100 MHz. The *IDIAG* control bit in the *System Command* register may be used to reset the minimum and maximum times observed and capture new data. Background scan information is normally used internally for test and validation.

The major functions executed by the background scan include:

- Monitoring system commands and internal recalculations on change of parameter values
- Updating hardware input status registers
- Updating input event status registers
- Updating fault and disable status registers
- Determination and updating of the operational command mode
- Updating output status event registers
- Updating hardware output status registers
- Updating analog outputs
- Monitoring of position *Teach* events
- Handling MODBUS Channel 1 commands
- Handling MODBUS Channel 2 commands

ADC Status Registers

Access to the DSP's internal ADC (*Analog to Digital Conversion*) Module values is provided through the registers in the *ADC Status Register Table*. These registers are normally used internally for testing and validation.

ADC Status Register Table

| ID | Name | Type* | Description |
|-----|--------|--------|--------------------------------------|
| 900 | ADC.0 | UINT16 | DSP ADC channel 0 (0x0000..0xFFFF0) |
| 901 | ADC.1 | UINT16 | DSP ADC channel 1 (0x0000..0xFFFF0) |
| 902 | ADC.2 | UINT16 | DSP ADC channel 2 (0x0000..0xFFFF0) |
| 903 | ADC.3 | UINT16 | DSP ADC channel 3 (0x0000..0xFFFF0) |
| 904 | ADC.4 | UINT16 | DSP ADC channel 4 (0x0000..0xFFFF0) |
| 905 | ADC.5 | UINT16 | DSP ADC channel 5 (0x0000..0xFFFF0) |
| 906 | ADC.6 | UINT16 | DSP ADC channel 6 (0x0000..0xFFFF0) |
| 907 | ADC.7 | UINT16 | DSP ADC channel 7 (0x0000..0xFFFF0) |
| 908 | ADC.8 | UINT16 | DSP ADC channel 8 (0x0000..0xFFFF0) |
| 909 | ADC.9 | UINT16 | DSP ADC channel 9 (0x0000..0xFFFF0) |
| 910 | ADC.10 | UINT16 | DSP ADC channel 10 (0x0000..0xFFFF0) |
| 911 | ADC.11 | UINT16 | DSP ADC channel 11 (0x0000..0xFFFF0) |
| 912 | ADC.12 | UINT16 | DSP ADC channel 12 (0x0000..0xFFFF0) |
| 913 | ADC.13 | UINT16 | DSP ADC channel 13 (0x0000..0xFFFF0) |
| 914 | ADC.14 | UINT16 | DSP ADC channel 14 (0x0000..0xFFFF0) |
| 915 | ADC.15 | UINT16 | DSP ADC channel 15 (0x0000..0xFFFF0) |

***See Appendix A for details on data Types**

Factory Identification Registers

Registers in this section are stored in *ROM (Read-Only Memory)* and are attributes of the firmware code flashed into the *DSP*. (Note that these registers are an exception to normal 'status' registers which are stored in *RAM*.)

System Identification Register Table

| ID | Name | Type* | Description |
|------|----------------|--------|--|
| 9910 | AppIdentifier | UINT16 | Application identifier |
| 9911 | AppVersion | UINT16 | Application firmware version [0.01 revision units] |
| 9916 | BootIdentifier | UINT16 | Boot code identifier |
| 9917 | BootVersion | UINT16 | Boot code firmware version [0.01 revision units] |

*See Appendix A for details on data Types

AppIdentifier

The *AppIdentifier* register specifies a factory specific product identifier used to distinguish between product families. Standard products will have values in the range 0 to 127. The value will always be two for standard *Tritex II* firmware. Customized firmware for special applications may will have values in the range 128 to 255.

AppVersion

The *AppVersion* register specifies the firmware revision of the application code. The value is specified in units of 0.01 revision units. For example, a value of 203 would indicate firmware *Revesion 2.03* of the product type specified by *AppIdentifier*.

BootIdentifier

The *BootIdentifier* register specifies a factory specific value used internally to identify the boot-strapping firmware resident in the *DSP*. This special firmware block is used to flash the application code into the *DSP*.

BootVersion

The *BootVersion* register specifies the firmware revision of the boot-strapping *DSP* code. The value is specified in units of 0.01 revision units.

Host Control

All registers in the *Host Register Table* are read-write (*MODBUS* holding registers). They are initialized to zero at power-up and are thereafter never modified by the drive's internal operation. These registers are used by a *MODBUS Master* that desires direct control over various features of the drive's runtime operation.

Host Register Table

| ID | Name | Type* | Description |
|------|------------------------|-----------------|--|
| 4302 | Disables | FLAGS | Disable drive flags |
| 4303 | CommandMode | OPMODE | Mode of operation |
| 4304 | Position | POS32 | Target position |
| 4306 | Velocity | VEL32 / UVEL32 | Velocity command / limit |
| 4308 | Acceleration | UACC32 | Acceleration limit |
| 4310 | Current | CUR16 / UCUR16 | Current command / limit |
| 4311 | Voltage | VOLT16 | Voltage command |
| 4312 | InputInhibits | FLAGS | Hardware input inhibits |
| 4313 | OutputInhibits | FLAGS | Hardware output inhibits |
| 4314 | Outputs | FLAGS | Direct outputs |
| 4315 | FactoryTest | UINT16 | Reserved for factory test and internal testing |
| 4316 | InputEvents.Mode. | IEG_MODE | Input Event Groups |
| 4317 | InputEvents.Motion | IEG_MOTION | |
| 4318 | InputEvents.MoveLevel | IEG_MOVE_LEVEL | |
| 4319 | InputEvents.MoveEdge | IEG_MOVE_EDGE | |
| 4320 | InputEvents.MoveTeach | IEG_MOVE_TEACH | |
| 4321 | InputEvents.MoveSelect | IEG_MOVE_SELECT | |
| 4322 | InputEvents.MoveSwitch | IEG_MOVE_SWITCH | |

*See Appendix A for details on data Types

Disables

The *Disables* register provides an easy method for a host controller to force the drive to be disabled. Any non-zero value will cause the *HOST* flag in the *Status.Disables* register to be set and disable the drive. A zero value will clear the *HOST* flag in the *Status.Disables* register and the drive may become enabled.

CommandMode

CommandMode allows the host to override the active drive command mode (the default or alternate mode). Any mode specified other than *Disabled Mode* will have priority and take effect immediately. The *Disabled Mode* (0) is used to indicate normal command mode operation and may be set by the host to relinquish direct control over the drive's command mode.

When a host specifies an operating mode (other than *Disabled*), the *DefaultModeActive* and *AlternateModeActive* status flags will remain INACTIVE, even if the mode specified by the host matches the mode selected by the default or alternate operating mode parameters.

Position

The *Position* register is used only when the drive's operating mode is *Host Position Mode*. It specifies the absolute target position for a 'simplified' move profile which utilizes the *Host.Velocity* and *Host.Acceleration* registers as limiting motion values to acquire the target position. Additionally, the *Host.Current* register is *always* used as the maximum current command allowed. The move profile is a simple absolute move without the secondary motion or termination options available to a standard move. The move has no dedicated move active or in-position status flags associated with it, though the general In Position status will become active when the target position is acquired.

Velocity

The *Velocity* register sets the limiting profile velocity used to achieve position in the *Host Position* operating mode and the target velocity for the *Host Velocity* operating mode. For the *Host Position* operating mode, the velocity specified should be an unsigned (*UVEL32*) value. When the *Velocity* register specifies the velocity target for the *Host Velocity* command mode, the value may be a signed (*VEL32*) value.

Acceleration

The *Acceleration* register sets the maximum acceleration that will be commanded in both the *Host Position* and *Host Velocity* modes of operation.

Current

The *Current* register sets the current command used in the *Host Current* and *Host Current Lock* modes of operation, and the maximum current that will be commanded in the *Host Position* and *Host Velocity* modes of operation. For the *Host Position* and *Host Velocity* operating modes, the maximum current value specified should be an unsigned (*UCUR16*) value. When the *Current* register specifies the current command for the *Host Current* and *Host Current Lock* command modes, the value may be a signed (*CUR16*) value.

Voltage

The *Voltage* register sets the voltage command used in the *Host Voltage* and *Host Voltage Lock* modes of operation.

InputInhibits

Digital inputs one through eight may be inhibited by setting the corresponding flag in *InputInhibits*. While an input is inhibited it cannot activate any input event assigned to it.

| | | | | | | | | II8 | II7 | II6 | II5 | II4 | II3 | II2 | II1 |
|----|----|----|----|----|----|---|---|-----|-----|-----|-----|-----|-----|-----|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

- II1 - inhibit digital input 1
- II2 - inhibit digital input 2
- II3 - inhibit digital input 3
- II4 - inhibit digital input 4
- II5 - inhibit digital input 5
- II6 - inhibit digital input 6
- II7 - inhibit digital input 7
- II8 - inhibit digital input 8

OutputInhibits

The drive's hardware outputs and LEDs normally reflect the status of any output status event assigned to them. When the output or LED is inhibited, any output status event assigned will not affect the output. This feature allows the host to take direct control of the hardware outputs (through *Host.Outputs*) and is normally used only for test purposes.

| | | | | OI4 | OI3 | OI2 | OI1 | | | | | OI4 | OI3 | OI2 | OI1 |
|----|----|----|----|-----|-----|-----|-----|---|---|---|---|-----|-----|-----|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

- OI1 - inhibit digital output 1
- OI2 - inhibit digital output 2
- OI3 - inhibit digital output 3
- OI4 - inhibit digital output 4
- LI1 - inhibit LED output 1
- LI2 - inhibit LED output 2
- LI3 - inhibit LED output 3
- LI4 - inhibit LED output 4

Outputs

The *Outputs* register allows the host to directly control the status of the hardware outputs and LEDs. Outputs are normally also activated through the output events assigned to the digital outputs. If the host desires exclusive control, it may either 'un-assign' the digital output(s) or inhibit the hardware event(s) from activating the outputs through the *OutputInhibits* register.

| | | | | L4 | L3 | L2 | L1 | | | | | O4 | O3 | O2 | O1 |
|----|----|----|----|----|----|----|----|---|---|---|---|----|----|----|----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

- O11 - set digital output 1
- O12 - set digital output 2
- O13 - set digital output 3
- O14 - set digital output 4
- L11 - set LED output 1
- L12 - set LED output 2
- L13 - set LED output 3
- L14 - set LED output 4

FactoryTest

This register is used for multiple purposes during drive test and commissioning. It is not used internally during normal drive operation and is available as a general purpose storage register.

InputEvents.x

The input event group maps give the host direct input into the input event system. Any flags set in these registers will activate the associated input event. Events are normally also activated through the input events assigned to the digital inputs. If the host desires exclusive control, it may either 'un-assign' the digital input(s) or inhibit the hardware input(s) through the *InputInhibits* register.

System Command Register Table

| ID | Name | Type* | Description |
|------|-------------|--------|---------------------------------|
| 4000 | SecurityKey | UINT16 | Security key |
| 4001 | Command | FLAGS | System command / response flags |

*See Appendix A for details on data Types

SecurityKey

The *SecurityKey* register is used to protect the drive from accidental or reckless system commands written to the *Command* register that may corrupt drive data and render the drive unusable. System commands for which security is required will check the *SecurityKey* before performing the requested action. If the key value is not *0x5AA5*, the command will be ignored and the *ERROR* flag will be set in the *Command* register. It is recommended that *SecurityKey* be written to zero (or any value other than *0x5AA5*) after the secure command is performed to remove the risk of future errors.

Although the *SecurityKey* operation is documented here, its use is **NOT** expected to be required by the user. The writing of *SecurityKey* is normally required only by the factory during the commissioning of the drive or by the *Tritex* user interface software for special operations. The factory should be consulted before attempting any operation involving the *SecurityKey*.

Command

The *Command* register is used to execute various internal system functions within the drive.

| ERROR | IF | IU | FLSH ¹ | | | | | | | ILOG ¹ | HUDT | IDIAG | SVFP ¹ | SVUP | RESTART |
|-------|----|----|-------------------|----|----|---|---|---|---|-------------------|------|-------|-------------------|------|---------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

¹Requires *SecurityKey*

RESTART

The *RESTART* flag forces a software power-on restart of the drive.

SVUP

The *SVUP* flag saves the current runtime values of all user parameters to non-volatile memory. The runtime values will be initialized to this state during a future power-on or software restart condition.

SVFP

The *SVFP* flag saves the current runtime values of all factory parameters to non-volatile memory. The runtime values will be initialized to this state during a future power-on or software restart condition. This command requires that the *SecurityKey* be set before the requested action is performed and is not intended for normal user use.

IDIAG

The *IDIAG* flag will resets various internal diagnostic variables to their initial values so that new values will be captured. The default reset values are variable dependent. If the variable is monitoring the minimum value of another variable, the reset value will be the maximum value. Similarly, if monitoring the maximum value of another variable, the reset value will be the minimum value. Variables monitoring counters or other variables will be reset to zero. Most variables affected are non-writable status variables and the *IDIAG* command is the only method available to directly modify their value.

The following internal variables are reset through the *IDIAG* command flag:

Status.Position.MinError, Status.Position.MaxError, Status.Velocity.MinError, Status.Velocity.MaxError, Status.Position.SineMin, Status.Position.SineMax, Status.Position.CosineMin, Status.Position.CosineMax, Status.Iloop.MaxImagnitude, Status.Iloop.MaxVbus, Status.Iloop.MinScanTime, Status.Iloop.MaxScanTime, Status.Iloop.MinExecutionTime, Status.Iloop.MaxExecutionTime, Status.HrSystem.IdLatchedValue, Status.HrSystem.IdLatchedCount.

HUDT

The *HUDT* flag forces a re-read of the Absolute Hall Position Feedback status variables which are not continually monitored by the system. This command is a convenience for internal factory testing and not intended for the user.

ILOG

The *ILOG* flag initializes the non-volatile status and fault logs to initial values and saves the initial values to non-volatile memory. This command requires that the *SecurityKey* be set before the requested action is performed and is not intended for normal user use.

FLSH

The *FLSH* flag forces the drive to exit normal drive operation and start execution of the firmware's *BOOT* code. This command requires that the *SecurityKey* be set before the requested action is performed and is not intended to be used during normal operation. The *BOOT* code contains the algorithms for reprogramming *DSP* code blocks and is not normally modified during the firmware upgrade process. The *FLSH* command is used during a firmware upgrade procedure to force the *DSP* to execute from *BOOT* code while reprogramming the application code blocks.

IU

The *IU* flag will initialize all user parameter registers to default values. Only the *RAM* image of the user parameters are initialized – the new values are *NOT* saved to non-volatile memory.

IF

The *IF* flag will initialize all factory parameter registers to default values. Only the *RAM* image of the user parameters are initialized – the new values are *NOT* saved to non-volatile memory.

ERROR

The *ERROR* flag is set if any of the specified actions cannot be executed or if an error occurred during execution of a command and the command failed to complete properly. The *ERROR* flag, once set, is never cleared internally. The user may read the value of the *Command* register before overwriting it with a new value to verify that the value is zero and the requested operation has succeeded.

Scope Control Registers

All registers in the *Scope Control Register Table* are read-write and are initialized to zero at start-up. Once the Scope Control Register Table has been properly configured and the *Control* register written to start data acquisition, Scope Control Register values must not be changed – changing any word in the table will clear the *ACTIVE* flag in the *Status* register of the *Scope Status Register Table*, halting any active scope data acquisition.

Scope Control Register Table

| ID | Name | Type* | Description |
|------|----------------|--------|-----------------------------------|
| 4100 | Channel1.ID | UINT16 | Channel 1 variable id |
| 4101 | Channel1.Flags | FLAGS | Channel 1 variable flags |
| 4102 | Channel2.ID | UINT16 | Channel 2 variable id |
| 4103 | Channel2.Flags | FLAGS | Channel 2 variable flags |
| 4104 | Channel3.ID | UINT16 | Channel 3 variable id |
| 4105 | Channel3.Flags | FLAGS | Channel 3 variable flags |
| 4106 | Channel4.ID | UINT16 | Channel 4 variable id |
| 4107 | Channel4.Flags | FLAGS | Channel 4 variable flags |
| 4108 | Trigger.ID | UINT16 | Trigger variable id |
| 4109 | Trigger.Flags | FLAGS | Trigger variable flags |
| 4110 | Trigger.Level | INT32 | Trigger level |
| 4112 | PreTrigger | UINT16 | Pre-trigger buffer size [UPDATES] |
| 4114 | UpdateRate | UINT16 | Scope update rate [SYS_TICKS] |
| 4115 | Control | FLAGS | Control command flags |

*See Appendix A for details on data Types

Channel1.ID

Channel2.ID

Channel3.ID

Channel4.ID

The *Channel ID* registers specify the *MODBUS* identifier of the variable to be monitored on the corresponding digital scope channel. The size (number of 16-bit words) of the channel variable's data collected in each scope update record is specified in the associated *ChannelX.Flags* register.

Trigger.ID

The *Trigger.ID* register specifies the *MODBUS* identifier of the variable whose value will be used to start (*trigger*) the collection of data from enabled scope channels. The size (number of 16-bit words) of the trigger variable's data is specified in the associated *Trigger.Flags* register. A valid *Trigger.ID* is required only if the *TR* or *TF* flag is set in the *Control* word.

Channel1.Flags

Channel2.Flags

Channel3.Flags

Channel4.Flags

Trigger.Flags

The variable *Flags* registers provide additional information about the type of variable assigned to the channel or trigger variables as specified in the following table.

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|----------|---|
| | | | | | | | | | | | | | | D | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

D

The *D* flag indicates that the variable is a double word (32-bit) variable. Every scope update record will require two words of storage for every double word channel variable enabled in the Control register and a single word of storage for every single word channel variable enabled in the Control.

Trigger.Level

Trigger.Level specifies the value of the *Trigger.ID* variable at which the scope will begin data acquisition of the channels selected in the *Control* word. *Trigger.Level* is used only if the *TR* or *TF* flag is set in the *Control* word. The size of *Trigger.Level* is determined by the *D* flag in *Trigger.Flags*. The default *Trigger.Level* value is zero and does not need to be specified unless scope data acquisition is being triggered and the default value of zero is unacceptable.

PreTrigger

The value of *PreTrigger* specifies the maximum number of scope data record acquisitions (updates) that will be saved in the scope data buffer before the scope's trigger criteria was met. When the scope triggers, there will be *PreTrigger* number of data acquisition records immediately available in the buffer. If the scope has not been active long enough to acquire all of the *PreTrigger* records, the early record values will be zero. The default *PreTrigger* value is zero and does not need to be specified unless scope data acquisition is being triggered and data values before the trigger point are desired.

UpdateRate

UpdateRate is automatically set to the default value of 100 SYS_TICKS (10 ms) whenever its current value is zero and any data is written to the *Scope Control Register Table*. *UpdateRate* will therefore always contain a valid non-zero data acquisition period and does not need to be specified unless the default period is unacceptable.

Control

The *Control* word is used to start and stop scope data acquisition, specifying the data channels to monitor and whether or not the acquisition should be started on the rising or falling edge of the trigger. The *Control* word should normally be the last control value written to the *Scope Control Register Table*.

| | | | | | | | | | | | | | | | | |
|-----------|----|----|----|----|----|---|---|---|---|---|-----------|-----------|------------|------------|------------|------------|
| SS | | | | | | | | | | | TR | TF | CH4 | CH3 | CH2 | CH1 |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |

- CH1**
- CH2**
- CH3**
- CH4**

The *CHX* flags enable the individual scope channels for data acquisition. *CHX* flags will be automatically cleared whenever any data is changed in the *Scope Control Register Table* and the associated *ChannelX.ID* does not specify a valid *MODBUS* identifier.

TR

When the *TR* (rising edge trigger) flag is set, data acquisition will begin when the current value of the *Trigger.ID* variable transitions from a value less than or equal to *Trigger.Level* to a value greater than *Trigger.Level*. The *TR* flag is cleared automatically whenever any data is changed in the *Scope Control Register Table* and *Trigger.ID* is not a valid *MODBUS* identifier.

TF

When the *TF* (falling edge trigger) flag is set, data acquisition will begin when the current value of the *Trigger.ID* variable transitions from a value greater than or equal to *Trigger.Level* to a value less than *Trigger.Level*. The *TF* flag is cleared automatically whenever any data is changed in the *Scope Control Register Table* and *Trigger.ID* is not a valid *MODBUS* identifier.

SS

The *SS* flag is used to start and stop scope data record acquisition.

Scope Status Registers

All registers in the *Scope Status Register Table* are read-only. After configuring and starting data acquisition through the *Scope Control Register Table*, the status registers may be used to monitor the scope's progress and to retrieve the acquired data.

Scope Status Register Table

| ID | Name | Type* | Description |
|-----|-------------|--------|--------------------------------------|
| 400 | Status | FLAGS | Scope status flags |
| 401 | RecordCount | UINT16 | # of records captured |
| 402 | MaxRecords | UINT16 | # of buffer records |
| 403 | RecordSize | UINT16 | Size of single update record |
| 404 | BufferSize | UINT16 | Size of data buffer |
| 405 | Timestamp | UINT16 | Time of data acquisition [SYS_TICKS] |
| 406 | Channel1 | INT32 | Last Channel 1 value |
| 408 | Channel2 | INT32 | Last Channel 2 value |
| 410 | Channel3 | INT32 | Last Channel 3 value |
| 412 | Channel4 | INT32 | Last Channel 4 value |
| 414 | Trigger | INT32 | Current trigger value |

*See *Appendix A* for details on data Types

Status

| ACTIVE | FULL | | | | | | | | | TR | TF | | | | | | |
|--------|------|----|----|----|----|---|---|---|---|----|----|---|---|---|---|--|--|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |

ACTIVE

The *ACTIVE* flag indicates that the scope data acquisition is active. The flag is cleared when data is written to the *Scope Control Register Table* SCOPE_STATUS_ACTIVE

FULL

The *FULL* flag indicates that the data acquisition buffer is full. The flag is cleared when scope acquisition is started (*Control* register written with the *SS* flag set). The flag is set when the scope has been triggered and the *RecordCount* is equal to *MaxRecords*.

TR

The *TR* flag indicates that data acquisition was triggered on the rising edge of the trigger variable. The flag is cleared when scope acquisition is started (*Control* register written with the *SS* flag set) and set when the *TR* (rising edge trigger) flag is set in the *Control* register and the value of the *Trigger.ID* variable transitions from a value less than or equal to *Trigger.Level* to a value greater than *Trigger.Level*.

TF

The *TF* flag indicates that data acquisition was triggered on the rising edge of the trigger variable. The flag is cleared when scope acquisition is started (*Control* register written with the *SS* flag set) and set when the *TF* (falling edge trigger) flag is set in the *Control* register and the value of the *Trigger.ID* variable transitions from a value greater than or equal to *Trigger.Level* to a value less than *Trigger.Level*.

RecordCount

RecordCount specifies the number of data records available for reading from the data buffer. *RecordCount* is initialized to zero when scope acquisition is started (*Control* register written with the *SS* flag set) and is set to the *PreTrigger* value when the scope is triggered. *RecordCount* is incremented on each data record acquisition (every *UpdateRate* ticks of *SYS_CLOCK*) after triggering.

MaxRecords

MaxRecords specifies the total number of data records that the data buffer can hold. *MaxRecords* is initialized when scope acquisition is started (*Control* register written with the *SS* flag set). If *RecordSize* is zero, *MaxRecords* is set to zero, otherwise the value of *MaxRecords* is calculated as: $MaxRecords = BufferSize / RecordSize$.

RecordSize

RecordSize specifies the size, in 16-bit words, of each data acquisition update record. *RecordSize* is updated automatically from the *CHX* enable flags in the *Control* register and the data sizes specified for the channel variables in the *ChannelX.Flags* registers whenever any data is changed in the *Scope Control Register Table*.

BufferSize

BufferSize specifies the total size, in 16-bit words, of the scope data buffer. The *TritexII* buffer size is normally 2K (2048) words.

Timestamp

Timestamp is a free-running counter incremented every data acquisition update (i.e. every *UpdateRate* *SYS_CLOCK* ticks). When the scope is not being used in trigger mode, *Timestamp* provides a relative indication of the acquisition time of the current data record.

Channel1**Channel2****Channel3****Channel4**

The channel registers provide the latest values observed on the scope data channels. The channel data is valid only if the associated *ChannelX.ID* value specifies a valid MODBUS variable.

Trigger

If the scope is active and *Trigger.ID* specifies a valid MODBUS register, *Trigger* will be updated at the *UpdateRate* with the current value of the *Trigger.ID* variable.

Logs

The drive automatically maintains data logs in non-volatile memory to track status information that may change at run-time. Data integrity of each log is maintained in a manner similar to that used for parameter data and is validated at power-up. Unlike parameter data, however, log information is not considered *critical* and therefore no fault or warning condition is indicated if a log is found to be corrupt at start-up. If a data validation error occurs the log will simply be initialized to a default starting state. (Note that a data log error should not occur after the factory commissioning of a drive - logged data should remain valid for the life of the drive.)

Data log registers, like other status information, are read-only. Data is updated (written) internally when necessary and the new data is automatically saved to non-volatile memory. Logs may be initialized default starting values through specific control commands.

Status Log

The *Status Log* maintains information on drive usage and worst-case stress values observed in non-volatile memory. Data changes are automatically updated in non-volatile memory as necessary.

Status Log Register Table

| ID | Name | Type* | Description |
|-----|-------------------|---------|---|
| 734 | Flags | FLAGS | Status log flags |
| 735 | PowerUpCount | UINT16 | Number of times drive has powered up |
| 736 | PwmRunTime | UINT32 | Total time PWM has been active [MINUTES] |
| 738 | AbsPositionOffset | POS32 | Absolute position offset |
| 740 | MaxCurrent | UCUR32 | Max current magnitude observed |
| 742 | MaxVbus | UVOLT32 | Max bus voltage observed |
| 744 | MaxBoardTemp | INT32 | Max PCB temperature observed [11.21 DEG C] |
| 746 | MaxActuatorTemp | INT32 | Max actuator temperature observed [11.21 DEG C] |

***See Appendix A for details on data Types**

Flags

| | | | | | | | | | | | | | STC | UNHOMED | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|-----|---------|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

UNHOMED

This flag is used only when the *Absolute Hall Feedback* option is selected for the actuator's position feedback device to indicate that the absolute position reference frame has not yet been established. The flag is set when a new reference frame is established (at the completion of a move that establishes a reference frame or upon the rising edge of a *Define Home* input event). The flag is cleared when a move that will establish a new reference upon completion is initiated, and also under certain fault conditions that indicate the loss of reference frame (*Position Tracking* fault, e.g.).

STC Startup Complete

This flag saves and restores the *Startup Complete* status between power-ups. The flag is set (and the *Status Log* is resaved to non-volatile memory) when a move with the *Set Startup Complete* option finishes execution. The flag is cleared when *Startup* is initiated, on the rising edge of *Reset Startup Complete*, and when the direction polarity flag (*DIR*) in configuration options is modified.

PowerUpCount

The *PowerUpCount* tracks the number of times that the drive has powered-up.

PwmRunTime

PwmRunTime tracks the total time the drive's *PWM* (actuator phase voltage) circuitry has been active. The *PwmRunTime* is, effectively, the total time that the drive has been enabled with addition of any *PWM* time required for brake activation and deactivation.

AbsPositionOffset

AbsPositionOffset is saved in the *Status Log* only when the *Absolute Hall Feedback* option is selected for the actuator's position feedback and specifies the offset between the free-running count read from the *Absolute Hall Feedback* board and the absolute reference frame.

MaxCurrent

MaxCurrent tracks the maximum magnitude of the current feedback vector observed.

MaxVbus

MaxCurrent tracks the maximum *DC Bus* voltage observed.

MaxBoardTemp

MaxBoardTemp tracks the maximum *PCB (Printed Circuit Board)* temperature observed.

MaxActuatorTemp

MaxActuatorTemp tracks the maximum actuator thermistor temperature observed for actuators that have thermistor temperature feedback. The value is not updated and will be a constant zero for actuators that use only digital switch temperature fault indicators.

Fault Log

The *Fault Log* maintains information of *FAULT* occurrences in non-volatile memory. Data changes are automatically updated in non-volatile memory as necessary.

Fault Log Register Table

| ID | Name | Type* | A | N | S | Description |
|-------|-----------------|--------|----|----|----|---------------------------------------|
| 782 | FaultCount | UINT16 | RO | 16 | FL | |
| 782 | FaultCount.0 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.0 |
| 783 | FaultCount.1 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.1 |
| 784 | FaultCount.2 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.2 |
| 785 | FaultCount.3 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.3 |
| 786 | FaultCount.4 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.4 |
| 787 | FaultCount.5 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.5 |
| 788 | FaultCount.6 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.6 |
| 789 | FaultCount.7 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.7 |
| 790 | FaultCount.8 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.8 |
| 791 | FaultCount.9 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.9 |
| 792 | FaultCount.10 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.10 |
| 793 | FaultCount.11 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.11 |
| 794 | FaultCount.12 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.12 |
| 795 | FaultCount.13 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.13 |
| 796 | FaultCount.14 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.14 |
| 797 | FaultCount.15 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.15 |
| 12502 | FaultCount.16 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.16 |
| 12503 | FaultCount.17 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.17 |
| 12504 | FaultCount.18 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.18 |
| 12505 | FaultCount.19 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.19 |
| 12506 | FaultCount.20 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.20 |
| 12507 | FaultCount.21 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.21 |
| 12508 | FaultCount.22 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.22 |
| 12509 | FaultCount.23 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.23 |
| 12510 | FaultCount.24 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.24 |
| 12511 | FaultCount.25 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.25 |
| 12512 | FaultCount.26 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.26 |
| 12513 | FaultCount.27 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.27 |
| 12514 | FaultCount.28 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.28 |
| 12515 | FaultCount.29 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.29 |
| 12516 | FaultCount.30 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.30 |
| 12517 | FaultCount.31 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.31 |
| 798 | PowerUpCount | UINT16 | RO | 16 | FL | |
| 798 | PowerUpCount.0 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.0 fault |
| 799 | PowerUpCount.1 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.1 fault |
| 800 | PowerUpCount.2 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.2 fault |
| 801 | PowerUpCount.3 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.3 fault |
| 802 | PowerUpCount.4 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.4 fault |
| 803 | PowerUpCount.5 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.5 fault |
| 804 | PowerUpCount.6 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.6 fault |
| 805 | PowerUpCount.7 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.7 fault |
| 806 | PowerUpCount.8 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.8 fault |
| 807 | PowerUpCount.9 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.9 fault |
| 808 | PowerUpCount.10 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.10 fault |
| 809 | PowerUpCount.11 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.11 fault |
| 810 | PowerUpCount.12 | UINT16 | RO | 1 | FL | Power-up count of last FAULT.12 fault |
| 811 | PowerUpCount.13 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.13 fault |

| | | | | | | |
|-------|----------------------------|--------|----|----|----|---------------------------------------|
| 812 | PowerUpCount.14 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.14 fault |
| 813 | PowerUpCount.15 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.15 fault |
| 12518 | PowerUpCount.16 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.16 fault |
| 12519 | PowerUpCount.17 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.17 fault |
| 12520 | PowerUpCount.18 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.18 fault |
| 12521 | PowerUpCount.19 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.19 fault |
| 12522 | PowerUpCount.20 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.20 fault |
| 12523 | PowerUpCount.21 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.21 fault |
| 12524 | PowerUpCount.22 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.22 fault |
| 12525 | PowerUpCount.23 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.23 fault |
| 12526 | PowerUpCount.24 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.24 fault |
| 12527 | PowerUpCount.25 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.25 fault |
| 12528 | PowerUpCount.26 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.26 fault |
| 12529 | PowerUpCount.27 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.27 fault |
| 12530 | PowerUpCount.28 | UINT16 | RO | 1 | FL | Power-up count of last FAULT.28 fault |
| 12531 | PowerUpCount.29 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.29 fault |
| 12532 | PowerUpCount.30 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.30 fault |
| 12533 | PowerUpCount.31 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.31 fault |
| 814 | PwmTime | UINT16 | RO | 32 | FL | |
| 814 | PwmTime.0 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.0 fault |
| 816 | PwmTime.1 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.1 fault |
| 818 | PwmTime.2 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.2 fault |
| 820 | PwmTime.3 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.3 fault |
| 822 | PwmTime.4 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.4 fault |
| 824 | PwmTime.5 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.5 fault |
| 826 | PwmTime.6 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.6 fault |
| 828 | PwmTime.7 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.7 fault |
| 830 | PwmTime.8 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.8 fault |
| 832 | PwmTime.9 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.9 fault |
| 834 | PwmTime.10 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.10 fault |
| 836 | PwmTime.11 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.11 fault |
| 838 | PwmTime.12 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.12 fault |
| 840 | PwmTime.13 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.13 fault |
| 842 | PwmTime.14 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.14 fault |
| 844 | PwmTime.15 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.15 fault |
| 12534 | PwmTime.16 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.16 fault |
| 12536 | PwmTime.17 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.17 fault |
| 12538 | PwmTime.18 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.18 fault |
| 12540 | PwmTime.19 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.19 fault |
| 12542 | PwmTime.20 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.20 fault |
| 12544 | PwmTime.21 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.21 fault |
| 12546 | PwmTime.22 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.22 fault |
| 12548 | PwmTime.23 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.23 fault |
| 12550 | PwmTime.24 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.24 fault |
| 12552 | PwmTime.25 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.25 fault |
| 12554 | PwmTime.26 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.26 fault |
| 12556 | PwmTime.27 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.27 fault |
| 12558 | PwmTime.28 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.28 fault |
| 12560 | PwmTime.29 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.29 fault |
| 12562 | PwmTime.30 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.30 fault |
| 12564 | PwmTime.31 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.31 fault |
| 846 | RecentFault | UINT16 | RO | 40 | FL | |
| 846 | RecentFault.0.ID | FAULT | RO | 1 | FL | FAULT ID of most recent fault |
| 847 | RecentFault.0.PowerUpCount | UINT16 | RO | 1 | FL | Power up count of most recent fault |
| 848 | RecentFault.0.RunTime | UINT32 | RO | 2 | FL | PWM run time of most recent fault |
| 850 | RecentFault.1.ID | FAULT | RO | 1 | FL | |
| 851 | RecentFault.1.PowerUpCount | UINT16 | RO | 1 | FL | |

| | | | | | | |
|-----|----------------------------|--------|----|---|----|--------------------------------------|
| 852 | RecentFault.1.RunTime | UINT32 | RO | 2 | FL | |
| 854 | RecentFault.2.ID | FAULT | RO | 1 | FL | |
| 855 | RecentFault.2.PowerUpCount | UINT16 | RO | 1 | FL | |
| 856 | RecentFault.2.RunTime | UINT32 | RO | 2 | FL | |
| 858 | RecentFault.3.ID | FAULT | RO | 1 | FL | |
| 859 | RecentFault.3.PowerUpCount | UINT16 | RO | 1 | FL | |
| 860 | RecentFault.3.RunTime | UINT32 | RO | 2 | FL | |
| 862 | RecentFault.4.ID | FAULT | RO | 1 | FL | |
| 863 | RecentFault.4.PowerUpCount | UINT16 | RO | 1 | FL | |
| 864 | RecentFault.4.RunTime | UINT32 | RO | 2 | FL | |
| 866 | RecentFault.5.ID | FAULT | RO | 1 | FL | |
| 867 | RecentFault.5.PowerUpCount | UINT16 | RO | 1 | FL | |
| 868 | RecentFault.5.RunTime | UINT32 | RO | 2 | FL | |
| 870 | RecentFault.6.ID | FAULT | RO | 1 | FL | |
| 871 | RecentFault.6.PowerUpCount | UINT16 | RO | 1 | FL | |
| 872 | RecentFault.6.RunTime | UINT32 | RO | 2 | FL | |
| 874 | RecentFault.7.ID | FAULT | RO | 1 | FL | |
| 875 | RecentFault.7.PowerUpCount | UINT16 | RO | 1 | FL | |
| 876 | RecentFault.7.RunTime | UINT32 | RO | 2 | FL | |
| 878 | RecentFault.8.ID | FAULT | RO | 1 | FL | |
| 879 | RecentFault.8.PowerUpCount | UINT16 | RO | 1 | FL | |
| 880 | RecentFault.8.RunTime | UINT32 | RO | 2 | FL | |
| 882 | RecentFault.9.ID | FAULT | RO | 1 | FL | FAULT ID of least recent fault |
| 883 | RecentFault.9.PowerUpCount | UINT16 | RO | 1 | FL | Power up count of least recent fault |
| 884 | RecentFault.9.RunTime | UINT32 | RO | 2 | FL | PWM run time of least recent fault |

***See Appendix A for details on data Types**

FaultCount

The total number of times a particular fault/warning has been logged is tracked in the *FaultCount* array. The bit number of the fault in the *FAULT* type specifies a particular fault's index in the *FaultCount* array.

PowerUpCount

The drive's power-up-count at the last occurrence of a particular fault/warning is tracked in the *PowerUpCount* array. The bit number of the fault in the *FAULT* type specifies a particular fault's index in the *PowerUpCount* array.

PwmTime

The total time the drive's *PWM* circuitry (phase voltage) has been active at last occurrence of a particular fault/warning is tracked in the *PwmTime* array. The bit number of the fault in the *FAULT* type specifies a particular fault's index in the *PwmTime* array.

RecentFault.N.ID

RecentFault.N.PowerUpCount

RecentFault.N.RunTime

The ten most recent faults/warnings that have been logged are available in the *RecentFault* array. The array is kept in chronological order with *RecentFault.0* being the most recent and *RecentFault.9* the least recent. Each entry contains the drive's power-up-count and *PWM* active time at the occurrence of the fault specified by the *FAULT* bitmap in the record's *ID*. To reduce redundant entries and preserve more useful fault history data, a new *RecentFault* entry will not be created for a fault whose data would have exactly matched the most recent record.

Appendix A - Types

This appendix defines the various data types used in the *Register Tables*.

All *MODBUS* registers contain sixteen bits of data. Data that requires more than sixteen bits uses multiple consecutive registers to store the data value. Integer data requiring more than sixteen bits is stored in *Little Endian* word order – the least significant data word is stored first (at the lowest register *ID*). All integer data is stored in two's complement format.

The drive's *DSP* controller does not directly support floating-point math. For efficiency, the drive uses fixed-point numeric representation for real numbers. A fixed-point number specifies the number of binary bits used to represent the integer part of the value and the number of binary bits used to represent the fractional part of the value. A fixed-point format of 2.14, for example, specifies a 16-bit word that uses two bits to represent the integer part and fourteen bits to represent the fractional part. A normal integer (in the range 0 to 65535) uses all 16 bits to represent the integer part of the value and could be specified as a 16.0 fixed-point number.

Specifying a particular data type for a register is a simple convenience to better describe the format and internal use of the data. All data could be typed only as *N-bit* ($N = 16, 32, 128$, etc) or *N-word* ($N = 1, 2$, etc) describing the number of bits or registers required to store the data. Specifying a data type of *UINT16* (instead of just '16') is more descriptive and carries the additional information that the register is a non-negative integer in the range of 0 to 65535. Taking this one step further, describing a register as type *UCUR16* instead of the more generic *UINT16* specifies that the value should be interpreted as an unsigned 9.7 fixed-point amperage value.

The structured data type is used for data items composed of multiple elements of different type and for data of a specific format that appears multiple times in the *Register Tables*. For each structured data type, the number of 16-bit words required to store a single item of the type is shown along with a base data type, if applicable.

Simple Types

The table below specifies the simple register data types used in the *Register Tables*. Simple data types are used for numeric data types of 16 or 32 bits. The fixed-point format, units, and numeric ranges are also specified if applicable.

Simple Data Types

| Type | Format | Units | Range | | Resolution | Description |
|--------|--------|----------|-------------|------------------------------|----------------------------|-----------------------------------|
| | | | min | max | | |
| FLAGS | | | | | | Bit-mapped data |
| ENUM | | | | | | Integer range of data |
| UINT16 | 16.0 | | 0 | 65535 | 1 | Unsigned 16-bit integer |
| INT16 | 16.0 | | -32768 | 32767 | 1 | Signed 16-bit integer |
| UINT32 | 32.0 | | 0 | 4294967295 | 1 | Unsigned 32-bit integer |
| INT32 | 32.0 | | -2147483648 | 2147483647 | 1 | Signed 32-bit integer |
| POS32 | 16.16 | REVS | -32768.0 | 32767.9999847412109375 | 0.0000152587890625 | 32-bit position/distance |
| UPOS32 | 16.16 | REVS | 0.0 | 65535.9999847412109375 | 0.0000152587890625 | Unsigned 32-bit position/distance |
| UPOS16 | 0.16 | REVS | 0 | 0.9999847412109375 | 0.0000152587890625 | 16-bit rev position |
| VEL32 | 8.24 | REVS/S | -128.0 | 127.999999940395355224609375 | 0.000000059604644775390625 | 32-bit signed velocity |
| VEL16 | 8.8 | REVS/S | -128.0 | 127.99609375 | 0.00390625 | 16-bit signed velocity |
| UVEL32 | 8.24 | REVS/S | 0 | 255.999999940395355224609375 | 0.000000059604644775390625 | 32-bit unsigned velocity |
| UVEL16 | 8.8 | REVS/S | 0 | 255.99609375 | 0.00390625 | 16-bit unsigned velocity |
| ACC32 | 12.20 | REVS/S/S | -2048.0 | 2047.99999904632568359375 | 0.00000095367431640625 | 32-bit signed acceleration |
| UACC32 | 12.20 | REVS/S/S | 0 | 4095.99999904632568359375 | 0.00000095367431640625 | 32-bit unsigned acceleration |

| | | | | | | |
|---------|-------|-------|---------|----------------------------|---------------------------|-------------------------|
| CUR32 | 9.23 | AMPS | -256.0 | 255.9999988079071044921875 | 0.00000011920928955078125 | 32-bit signed current |
| CUR16 | 9.7 | AMPS | -256.0 | 255.9921875 | 0.0078125 | 16-bit signed current |
| UCUR32 | 9.23 | AMPS | 0 | 511.9999988079071044921875 | 0.00000011920928955078125 | 32-bit unsigned current |
| UCUR16 | 9.7 | AMPS | 0 | 511.9921875 | 0.0078125 | 16-bit unsigned current |
| VOLT32 | 11.21 | VOLTS | -1024.0 | 1023.999999523162841796875 | 0.000000476837158203125 | 32-bit signed voltage |
| VOLT16 | 11.5 | VOLTS | -1024.0 | 1023.96875 | 0.03125 | 16-bit signed voltage |
| UVOLT32 | 11.21 | VOLTS | 0 | 2047.999999523162841796875 | 0.000000476837158203125 | 32-bit unsigned voltage |
| UVOLT16 | 11.5 | VOLTS | 0 | 2047.96875 | 0.03125 | 16-bit unsigned voltage |

STR16

| Type | Base Type | Words | Description |
|-------|-----------|-------|---------------------|
| STR16 | UINT16 | 16 | 16 character string |

The *STR16* type is used to hold an ASCII character string. Each word encodes a printable ASCII character in the low eight bits (the high eight bits of each word are unused). The *STR16* data type is used to hold displayable text strings used for identification and informational purposes only.

FAULT

| Type | Base Type | Words | Description |
|-------|-----------|-------|------------------------|
| FAULT | FLAGS | 2 | Bit-mapped fault flags |

The *FAULT* type is a bit-mapped word with each bit representing a specific fault that may occur in drive. The *FAULT* type appears in multiple *Register Tables* and is used for both parameter set-up and status information.

| RS | FP | UP | HB | IH | COM | LOS | AT | BT | FE | VHIGH | VLOW | MV | POS | IC | IPK |
|----|----|----|----|----|-----|-----|----|----|----|-------|------|----|-----|----|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|------------|
| | | | | | | | | | | | | | | | LVW |
| 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |

IPK – Peak Current

A *Peak Current* fault occurs when the instantaneous magnitude of the current feedback vector exceeds the maximum allowable value. The maximum value is set at the factory and is available in the *Itrip* parameter of the *Factor Limits Register Table*. *Peak Current* faults may be caused by a short circuit condition, sudden decelerations (hitting a hard stop), or poor tuning that results in unstable control loop operation.

IC – Continuous Current

A *Continuous Current* fault occurs when the absolute value of the average feedback current of the drive exceeds the drive's continuous current rating. The continuous current rating of the drive is set at the factory and is available in the *Icontinuous* parameter of the *Factor Limits Register Table*.

POS – Position Tracking

A *Position Tracking* fault is generated internally when the drive cannot satisfactorily monitor the drive's feedback position. The possible causes of a *Position Tracking* fault will vary with type of position feedback device being used on the actuator. This fault will clear the *Homed* output status event and the drive's absolute position reference frame may need to be reestablished.

MV – Move Termination

A move completes (terminates) upon occurrence of an input event, a current feedback threshold value, or completion of the travel distance to its new position. Any or all of these move termination options may be specified in the move set-up parameters to generate a *Move Termination* fault.

VLOW – Low DC Bus Voltage

A *Low DC Bus Voltage* fault occurs when the drive is enabled and the DC bus voltage falls below the minimum allowable voltage. The minimum voltage is set at the factory and is available in the *LowVoltageTripLevel* parameter of the *Factor Limits Register Table*. This fault is conditional on the drive being enabled since the drive's logic (and DSP) may remain powered while voltage is removed from the DC bus.

VHIGH – High DC Bus Voltage

A *High DC Bus Voltage* fault occurs whenever the DC bus voltage rises above the maximum allowable voltage. The maximum voltage is set at the factory and is available in the *HighVoltageTripLevel* parameter of the *Factory Limits Register Table*. *High DC Bus Voltage* faults may occur when bus voltage is elevated from the motor regeneration energy. Possible solutions are slower accelerations or other methods of storing or shunting the energy by connecting an external braking resistor. Note that, unlike the *Low DC Bus Voltage* fault, a *High DC Bus Voltage* fault may occur even if the drive is disabled.

FE – Positional Following Error

A *Positional Following Error* fault occurs when the absolute value of the difference between drive's commanded and feedback positions remains greater than the maximum allowable following error for a specified amount of time. The time period allows for some hysteresis and avoids spurious faults during rapid accelerations or momentarily high current loading due to load change or stiction. The maximum error and its associated time period are user parameters described in the *Limits Register Table*.

BT – Board Temperature

A *Board Temperature* fault occurs when the *PCB (Printed Circuit Board)* temperature exceeds maximum allowable value. The maximum value is set at the factory and is available in the *BoardTempTripLevel* parameter of the *Factor Limits Register Table*. Board Temperature faults will occur if the actuator is continuously operated above its power rating.

AT – Actuator Temperature

The drive monitors an analog signal from the actuator which is configured at the factory as the input from either a thermistor or a simple (active high) switch. If the input is configured as a thermistor, an *Actuator Temperature* fault is generated if the measured value exceeds the maximum allowable actuator temperature. The maximum value is set at the factory and is available in the *ActuatorTempTripLevel* parameter of the *Factor Limits Register Table*. If the input is configured as a simple switch, an *Actuator Temperature* fault is generated when the measured value exceeds approximately 2.4V.

LOS – Loss of Signal

A *Loss of Signal* fault is generated when an analog input detects a value that is below its low trip value or above its high trip value and the offending low or high trip detection option is enabled. If multiple analog input signals are configured to generate *Loss of Signal* faults, there is no direct way to determine which input was the source of the fault. The analog input signal values may be observed (read) if necessary.

IH – Hardware Overcurrent

A *Hardware Overcurrent* fault occurs when current sensing circuitry detects extremely high current on the DC bus. The threshold trip value is greater than current feedback values expected under normal operating conditions and may be an indication that the actuator phase windings have been shorted. The *Hardware Overcurrent* fault cannot be masked by removing this bit from the hard fault mask. A hardware overcurrent fault will always be generated if detected.

COM – Communications

A *Communications* fault occurs when a communication error occurs that has been selected to cause this fault. The selection is done via the Comms Faults Setup tab.

HB – Absolute Hall Board Battery

An *Absolute Hall Board Battery* fault will occur only if the drive is using an Absolute Hall position feedback device and the battery level of the device falls below 2.8V. The Absolute Hall position feedback circuitry requires the battery to maintain feedback position monitoring while the drive is powered down and the *Absolute Hall Board Battery* fault is an indication that the feedback board's battery requires replacement.

UP – User Parameters

If the user parameter data block in non-volatile memory appears invalid at start-up, a *UserParameters fault* is generated and the user parameters in *RAM* are initialized to default values. A *UserParameters* fault cannot be masked by removing this bit from the hard fault mask and cannot be reset through either a fault reset or the rising edge of ENABLE. The fault will be automatically cleared when user parameters are saved to non-volatile memory.

FP – Factory Parameters

If the factory parameter data block in non-volatile memory appears invalid at start-up, a *FactoryParameters fault* is generated and the factory parameters in *RAM* are initialized to default values. A *FactoryParameters* fault cannot be masked by removing this bit from the hard fault mask and cannot be reset through either a fault reset or the rising edge of ENABLE. The fault will be automatically cleared when factory parameters are saved to non-volatile memory.

RS – Restart

A *Restart* fault indicates that the drive has internally restarted without powering down. This is an abnormal occurrence and should not occur unless the drive could not properly execute code. The *Restart* fault cannot be masked by removing this bit from the hard fault mask and cannot be reset through either a fault reset or the rising edge of ENABLE. A power cycle will be required to reset the drive.

LVW – Low DC Bus Voltage Warning

A *Low DC Bus Voltage* warning occurs when the drive is enabled and the DC bus voltage falls below the warning voltage as set by the user. This fault is conditional on the drive being enabled since the drive's logic (and *DSP*) may remain powered while voltage is removed from the DC bus. The warning will be automatically cleared when the DC Bus Voltage goes above the warning voltage off value which is also set by the customer.

OPMODE

| Type | Base Type | Words | Description |
|--------|-----------|-------|-------------------------|
| OPMODE | ENUM | 1 | Command operating modes |

OPMODE is an enumerated value type specifying a particular drive command operating mode. The type is used for the default and alternate operating mode parameters, the host direct operating control mode, and the current operating mode status registers. Valid *OPMODE* values and their corresponding drive operational command mode are specified in the table below.

OPMODE Enumerations

| Value | Operational Command Mode |
|-------|----------------------------------|
| 0 | Disabled Mode |
| 1 | Digital Inputs Mode |
| 2 | Analog Position Mode |
| 3 | Analog Velocity Mode |
| 4 | Analog Current Mode |
| 5 | Host Position Mode ¹ |
| 6 | Host Velocity Mode ¹ |
| 7 | Host Current Mode ¹ |
| 8 | Current Lock Mode ^{1,2} |
| 9 | Voltage Lock Mode ^{1,2} |

| | |
|----|-----------------------------|
| 10 | Voltage Mode ^{1,2} |
|----|-----------------------------|

¹ Not assignable through user interface

² Factory test and calibration modes

Disabled Mode

The *Disabled Mode* will force the drive to become disabled. The *Disabled Mode*, when assigned to *Host.CommandMode*, is also used to indicate that *Host.CommandMode* is no longer active.

Digital Inputs Mode

The *Digital Inputs Mode* allows for the execution of the sixteen *Move* profiles through *Move Momentary* and *Move Maintained* input events.

Analog Position Mode

Analog Position Mode provides position control proportional to an analog input value. While *Analog Position Mode* is active, the drive continually attempts to achieve the absolute position command specified from the analog input within the velocity and acceleration limits set in the *Analog Position Control* registers.

Analog Velocity Mode

Analog Velocity Mode provides velocity control proportional to an analog input value. While *Analog Velocity Mode* is active, the drive continually attempts to achieve the velocity command specified from the analog input within the acceleration limit set in the *Analog Velocity Control* registers.

Analog Current Mode

Analog Current Mode provides current (torque) control proportional to an analog input value. While *Analog Current Mode* is active, the drive continually attempts to achieve the current command specified from the analog input.

Host Position Mode

While the command mode is *Host Position Mode* the drive will be forced into an internal position control mode which will continually attempt to achieve the absolute position specified by the *Host.Position* register using the *Host.Velocity*, *Host.Acceleration*, and *Host.Current* limits.

Host Velocity Mode

While the command mode is *Host Velocity Mode* the drive will be forced into an internal position control mode which will continually attempt to achieve the velocity specified by the *Host.Velocity* register using the *Host.Acceleration*, and *Host.Current* limits.

Host Current Mode

While the command mode is *Host Current Mode* the drive will be forced into an internal current control mode which will continually attempt to achieve the current feedback specified by the *Host.Current* register.

Host Position, *Host Velocity*, and *Host Current* operating modes require an active host controller to be useful and are not normally available for assignment to user operating modes through the *Tritex* user interface software.

Current Lock Mode

The *Current Lock Mode* is used for rotor alignment during factory commissioning. The drive will not track the electrical feedback angle but will instead force the electrical angle specified by the *Offset* register using the *Host.Current* register for the phase current command value.

Voltage Lock Mode

The *Voltage Lock Mode* is used for test and calibration of the actuator phase currents. The drive will not track the electrical feedback angle but will instead force the electrical angle specified by the *Offset* register using the *Host.Voltage* register for the phase voltage command value.

Voltage Mode

The *Voltage Mode* is used for internal factory test and calibration. The actuator phases are directly commanded with sinusoidal voltage commands of the magnitude specified by the *Host.Voltage* register. The current control loop is disabled while direct voltage mode is active.

Current Lock, *Voltage Lock*, and *Voltage* modes are not normally available for assignment to user operating modes through the *Tritex* user interface software. They are usually specified only in host control mode and are used during factory commissioning for test and alignment.

Input Event Groups

This section defines the input event flags in each of the input event status groups.

Input Event Group Types

| Type | Base Type | Words | Description |
|-----------------|-----------|-------|--|
| IEG_MODE | FLAGS | 1 | Enable, mode input events |
| IEG_MOTION | FLAGS | 1 | General motion input events (jog, home, dedicated move...) |
| IEG_MOVE_LEVEL | FLAGS | 1 | Individual move maintained (level) initiates |
| IEG_MOVE_EDGE | FLAGS | 1 | Individual move momentary (edge) initiates |
| IEG_MOVE_TEACH | FLAGS | 1 | Individual move teach position |
| IEG_MOVE_SELECT | FLAGS | 1 | Binary selects |
| IEG_MOVE_SWITCH | FLAGS | 1 | Move (feed) switches (level and edge) |

IEG_MODE

| RESET | BKOV | TSEL | TENA | H2 | H1 | | | ALT | | | | | | EL | EE |
|-------|------|------|------|----|----|---|---|-----|---|---|---|---|---|----|----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

EE – Enable Momentary

The rising edge of the *Enable Momentary* input will reset any active hard faults. If all hard faults are successfully cleared the drive will become enabled. The drive be disabled while the input is inactive. After the occurrence of a hard fault, a new rising edge will be required to re-enable the drive (compare with *Enable Maintained*, below).

EL – Enable Maintained

The Enable Maintained operates in a manner similar to the Enable Momentary input. Like the momentary enable, the rising edge of Enable Maintained will reset faults. A new rising edge, however, is not required after resetting faults through the RESET input – the drive will automatically enable whenever no hard faults are pending and Enable Maintained is active.

ALT – Alternate Operating Mode

Sets the operational command mode of the drive to the mode specified in the *Alternate Operating Mode* register. While the ALT input event is inactive, the operational command mode of the drive is set to the mode specified in the *Default Operating Mode* register.

H1 – Define Home Position 1

The drive's absolute position is set to *Home.Position1* on the rising edge of the H1 input, establishing the absolute reference frame and setting the *Homed* output status flag.

H2 – Define Home Position 2

The drive's absolute position is set to *Home.Position2* on the rising edge of the H2 input, establishing the absolute reference frame and setting the *Homed* output status flag.

TENA – Move Teach Enable

While the TENA input is active, move teach functionality will be enabled. Move positions may be set either through *IGROUP 4* individual move teach inputs, or by selecting the move number on the binary select inputs of *IGROUP 5* and then setting the TSEL flag (below). Teach functionality may also be enabled automatically at drive power-up through the TE flag of the *Configuration.Options* register, eliminating the requirement for a dedicated input.

TSEL – Teach Selected Move Position

The rising edge of the *TSEL* input with teach functionality enabled (*TENA* active) will cause the current absolute position of the drive to be set in the position parameter of the move number selected on the binary select inputs of *IGROUP 5*.

BKOV – Brake Override

The *BKOV* input forces the actuator brake relay to be activated, releasing the brake. This input is honored whether or not the drive is enabled and overrides the normal brake behavior.

RESET – Fault Reset

The rising edge of the *RESET* input will clear any faults active. If all pending 'hard' faults are successfully cleared, the drive will become enabled if the Maintained Enable input is active or a rising edge of the Momentary Enable is observed. *RESET* allows faults to be cleared independently of the drive enable inputs (*Enable Momentary* or *Enable Maintained*).

IEG_MOTION

| | | | | | | | | | | | | | | | |
|----|------------|------------|------------|------------|--------------|---|-------------|---|-------------|-------------|-------------|--------------|-------------|---|---|
| | STR | STU | MVE | MVL | EMOVE | | HOME | | JOGF | JOGN | JOGP | PAUSE | STOP | | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

STOP – Stop Motion

The *STOP* input event forces the drive to decelerate using *STOP* deceleration and hold position. The drive will be forced into a position mode of operation if necessary.

PAUSE – Pause Move

If any move is executing, the *PAUSE* input event will force the drive to decelerate to zero command velocity using the current motion's deceleration and hold position until *PAUSE* is removed. If no move is active, the *PAUSE* input event has no effect.

JOGP – Jog Positive

JOGN – Jog Negative

The *JOGP* and *JOGN* input events will begin jog motion. If both input events are active, the drive will command zero velocity and hold position.

JOGF – Jog Fast

While the *JOGF* input event is active, the target velocity for an active jog will be set the value in the *Jog.FastVelocity* register. While *JOGF* is inactive, the value in the *Jog.SlowVelocity* register is used.

HOME – Initiate Home Move

The rising edge of the *HOME* input event initiates the Home Move.

EMOVE – Initiate Dedicated Move (Emergency Move)

The *EMOVE* input event provides maintained move initiate functionality for the Dedicated Move in the same manner as the individual move maintained input events.

MVL – Initiate Maintained (level sensitive) Binary Select Move

The *MVL* input executes the move number specified on the binary select inputs while the *MVL* event remains active in the same manner that the individual Move Maintained initiates operate.

MVE – Initiate Momentary (edge sensitive) Binary Select Move

The move number specified on the binary select inputs will be executed on the rising edge of the *MVL* input event in the same manner that the individual *Move Momentary* initiates operate. The move number does not need to be maintained on the binary select inputs after the move has begun execution.

STU – Startup

Resets *Startup Complete* and initiates *Move 15*. The *Startup* function is the only motion command accepted while *Startup Complete* is inactive and *Startup Required* has been selected as a configuration option. A move in the move sequence started through *Move 15* will normally have the *Set Startup Complete* option flag selected which will cause *Startup Complete* to be set when the move finishes.

STR – Reset Startup Complete

The rising edge of *STR* will resets the *Startup Complete* flag. If *Startup Required* has been selected as a configuration option, no motion other than *Startup* motion will be allowed until *Startup Complete* is again set (normally through the execution of *Startup*).

IEG_MOVE_LEVEL

| L15 | L14 | L13 | L12 | L11 | L10 | L9 | L8 | L7 | L6 | L5 | L4 | L3 | L2 | L1 | L0 |
|------------|------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

The *IEG_MOVE_LEVEL* input events will execute the move specified by the highest active event bit while the bit remains active. Any next move that has been set for the move is ignored when moves are executed with the maintained (level) input events. A move initiated through a maintained input event has priority over (and will interrupt and override) an executing move that was initiated with a momentary input event.

IEG_MOVE_EDGE

| E15 | E14 | E13 | E12 | E11 | E10 | E9 | E8 | E7 | E6 | E5 | E4 | E3 | E2 | E1 | E0 |
|------------|------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

The *IEG_MOVE_EDGE* input events will execute the move specified on the rising edge of the input event. The event does not need to remain active. A move must be initiated with a momentary input event in order for it to execute another move automatically upon completion. A move initiated through a maintained input event has priority over (and will interrupt and override) a move initiated with a momentary input event.

IEG_MOVE_TEACH

| M15 | M14 | M13 | M12 | M11 | M10 | M9 | M8 | M7 | M6 | M5 | M4 | M3 | M2 | M1 | M0 |
|------------|------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

The rising edge of an *IEG_MOVE_TEACH* input event will store the drive's current absolute position in the move's position register. The teach mode must be enabled and an absolute position reference frame must be active before move positions may be taught.

IEG_MOVE_SELECT

| | | | | | | | | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
|----|----|----|----|----|----|---|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

The B0 through B7 select a move number that for the binary select move initiate and move teach input events. Each flag provides a 2ⁿ binary value towards the final move number.

IEG_MOVE_SWITCH

| | | | | | | | | | | | | | | | |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| E8 | E7 | E6 | E5 | E4 | E3 | E2 | E1 | L8 | L7 | L6 | L5 | L4 | L3 | L2 | L1 |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

The switch group specifies input events that may be selected to terminate move segments. The L1 through L7 input events provide maintained (level) input event functionality. The E1 through E8 input events provide momentary (edge) input event functionality. Switch inputs may be selected as move termination events.

Output Event Groups

This section defines the output status event flags in each of the output event status groups.

Output Event Group Types

| Type | Base Type | Words | Description |
|----------------------|-----------|-------|-------------------------|
| OEG_STATUS | FLAGS | 1 | General drive status |
| OEG_MOTION | FLAGS | 1 | General motion status |
| OEG_CONTROL | FLAGS | 1 | Internal control status |
| OEG_MOVE_ACTIVE | FLAGS | 1 | Active move status |
| IEG_MOVE_IN_POSITION | FLAGS | 1 | Move in-position status |

OEG_STATUS

| | | | | | | | | | | | | | | | |
|----|----|----|------------|----|----|---|---|-------------|-------------|-----------|-------------|------------|------------|--------------|------------|
| | | | STC | | | | | ALTM | DEFM | FW | WARN | FLT | RDY | HOMED | ENA |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

ENA – Enabled

The *ENA* flag will be active when no flags are set in the Disables status word and the drive becomes enabled.

HOMED – Homed

The *HOMED* flag is set when a move completes that establishes an absolute reference frame or a rising edge of the *Define Home 1* or *Define Home 2* input event is observed.

READY – Ready

The *READY* flag is set when both the *ENA* and *HOMED* flags are active indicating that the drive is homed and enabled.

FLT – Faulted

The *FLT* flag is latched when hard fault is active. The flag is cleared on the rising edge of *ENA* or the rising edge of a *Reset Faults* input event.

WARN – Warning

The *WARN* flag is set while a soft fault is active. The flag is cleared automatically when the *FAULT* contributing to the warning is removed.

FW – Fault or Warning

The *FW* is the logical 'or' of the *FLT* and *WARN* flags.

DEFM – Default Mode of Operation

The *DEFM* flag will be active while the default mode of operation is active.

ALTM – Alternate Mode of Operation

The *ALTM* flag will be active while the alternate mode of operation is active.

STC – Startup Complete

The *STC* flag will be active when Startup has completed. It follows the state of the *Startup Complete* flag in the *Status Log*.

OEG_MOTION

| EP | H2P | H1P | IP | | SMV | MV | EMV | | ST | HMV | JM | JP | J | PAUSED | STOPPED |
|----|-----|-----|----|----|-----|----|-----|---|----|-----|----|----|---|--------|---------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

STOPPED – Stopped

The *STOPPED* flag is active while the *STOP* input event is active.

PAUSED – Paused

The *PAUSED* flag is active while any move is active and the *PAUSE* input event is active. While active the drive will decelerate to a stop using the current motion’s acceleration parameter and hold position until the *PAUSE* input event becomes inactive.

J – Jogging

JP – Jogging (+)

JM – Jogging (-)

The *J* flag will be active while the drive is executing jog motion. If the direction of motion is positive, the *JP* flag will be active, if negative the *JM* flag will be active.

While both the Jog Positive and Jog Negative input events are active, the *J*, *JP*, and *JM* output status events will all be active and the drive will decelerate to zero velocity and hold position.

HMV – Homing Active

The *HMV* flag is active while the Home move is executing.

ST – Startup Active

The *ST* flag is active while the Startup function is executing.

EMV – Dedicated (emergency) Move Active

The *EMV* flag is active while the Dedicated Move is executing.

MV – Move Active

The *MV* flag is active while any move (including the Home and Dedicated Move) is executing.

SMV – Secondary Move Active

The *SMV* flag is active while the secondary segment of any move (including the Home and Dedicated Move) is executing.

IP – In Position

The *IP* flag is active when the drive is enabled, a position control mode is active, the command velocity is zero, and the absolute value of position error has remained less than the maximum allowable position error value for at least the time specified by the position error window time parameter.

H1P – At Home.Position1

The *H1P* flag is active when the *IP* is active and the commanded position is *Home Position 1*.

H2P – At Home.Position2

The *H2P* flag is active when the *IP* is active and the commanded position is *Home Position 2*.

EP – At Dedicated Move Position

The *H1P* flag is active when the *IP* is active and the commanded position is the position specified for the final segment of the *Dedicated Move*.

OEG_CONTROL

| | | | | | | | | | | | | | | | |
|----|----|------------|--------------|------------|------------|------------|------------|-----------|------------|------------|-----------|-----------|---------------|-------------|-------------|
| | | PWM | BKDLY | AUP | ILS | PLM | PLP | PL | ILM | ILP | IL | VL | IRATED | BRKR | SHNT |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

SHNT – Shunt Active

The *SHNT* flag is active while the DC Bus shunt relay is active.

BRKR – Brake Release Active

The *BRKR* flag is active while the Brake Release relay is active.

IRATED – Over Rated (continuous) Current

The *IRATED* is active whenever the magnitude of the current feedback vector is greater than the drive's continuous current rating.

VL – Voltage Limited

The *VL* flag is active when the drive command requires more current than can be delivered from the DC Bus and the controller is being voltage limited.

IL – Current Limited

ILP – Current Limited (+)

ILM – Current Limited (-)

The *IL* flag is set whenever the position controller requires more current than can be delivered due the current command being limited. If the drive requires more positive current than can be delivered, the *ILP* flag will be set. If the drive requires more negative current than can be delivered, the *ILM* flag will be set.

PL – Position Limit Active

PLP – Position Limited (+)

PLM – Position Limited (-)

The *PL* flag is set whenever the position command has moved past an enabled position limit. If the drive has passed the enabled positive limit, the *PLP* flag will be set. If the drive has passed the enabled negative limit, the *PLM* flag will be set.

ILS – Seating Current Limit Active

The *ILS* flag is set on the rising edge of *PL* (position limit active) and remains active for the time specified for current limit seating.

AUP – Analog Unipolar Input 1 (0 – 10V)

The *AUP* flag is set when *Analog Input 1* has been selected for unipolar operation.

BKDLY – Brake Delay Active

The *BKDLY* flag will be active while the drive is controlling actuator phase voltages (*PWM* is active) but the drive is not enabled. This occurs with a non-zero brake delay.

PWM – PWM Active

The *PWM* flag is set when the *PWM* circuitry becomes active controlling the actuator phase voltages. The *PWM* may be active before the drive indicates that it is enabled if there is non-zero brake delay.

OEG_MOVE_ACTIVE

| | | | | | | | | | | | | | | | |
|------------|------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| M15 | M14 | M13 | M12 | M11 | M10 | M9 | M8 | M7 | M6 | M5 | M4 | M3 | M2 | M1 | M0 |
|------------|------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

A flag in the *OEG_MOVE_ACTIVE* output status event group is active while the corresponding Move is executing.

OEG_MOVE_IN_POS

| M15 | M14 | M13 | M12 | M11 | M10 | M9 | M8 | M7 | M6 | M5 | M4 | M3 | M2 | M1 | M0 |
|------------|------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

A flag in the *OEG_MOVE_IN_POS* output status event group is active when the *IP* flag is active in the *OEG_MOTION* register and the command position matches the final segment position of the corresponding move. Note that multiple flags may be active.

The *MOVE* type defines the standard motion registers used for the Move, Home, and Dedicated Move motion profiles.

MOVE Structure Table

| Offset | Name | Type | Size | Description |
|--------|--------------------|-----------------|------|------------------------------------|
| 0 | Options | FLAGS | 1 | Move option control flags |
| 1 | CurrentLimit | UCUR16 | 1 | Move current limit |
| 2 | Acceleration | UACC32 | 2 | Move acceleration |
| 4 | TerminationSwitch | IEG_MOVE_SWITCH | 1 | Move termination switches |
| 5 | NextMove | UINT16 | 1 | Next move |
| 6 | Primary.Options | FLAGS | 1 | Primary motion control flags |
| 7 | | UINT16 | 1 | reserved |
| 8 | Primary.Position | POS32 | 2 | Primary motion position/distance |
| 10 | Primary.Velocity | UVEL32 | 2 | Primary motion velocity |
| 12 | Secondary.Options | FLAGS | 1 | Secondary motion control flags |
| 13 | | UINT16 | 1 | reserved |
| 14 | Secondary.Position | POS32 | 2 | Secondary motion position/distance |
| 16 | Secondary.Velocity | UVEL32 | 2 | Secondary motion velocity |

Deceleration

Deceleration can be set for a move and will be used if the motion returns to zero velocity. The Modbus address for Decel 0 is 6500. The Modbus address for all moves is 6500 + Move# *2. It is of the same type as Acceleration. If the deceleration value is set to zero, the acceleration value will be used in its place.

Options

General options for the move are set through the bitmapped fields of the *Options* parameter as specified in the following table.

| STC | APMAX | APMIN | | | | | | | REF2 | REF1 | | WAIT | NEXT | SM | |
|-----|-------|-------|----|----|----|---|---|---|------|------|---|------|------|----|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

SM – Secondary Motion Enable

If secondary motion is not enabled, the move will execute only the primary motion segment.

NEXT – Auto-Execute Next MOVE

The *MOVE* specified in *NextMove* is will be executed when the move completes if the *NEXT* flag is set in the *Options* register.

WAIT – Wait for In-Position Active

This flag may be set to require the *IN_POSITION* status flag to be active before the *MOVE* is considered complete. The *MOVE* remains active until the in-position conditions are met.

REF1 – Set Absolute Reference Position 1

REF2 – Set Absolute Reference Position 2

If the *REF1* (*REF2*) flag is set, the absolute position of the drive will be set to *HOME.Position1* (*HOME.Position2*) upon completion of the *MOVE*, establishing a new absolute position reference frame. (If both *REF1* and *REF2* are set, *REF1* has priority and the *REF2* flag is ignored.) The establishment of the reference frame will be the final action taken in completion of the *MOVE* and will not occur until the *In-Position* criteria has been met if selected by the *WAIT* flag. Once an absolute reference frame has been established, the drive is considered to be *Homed* (see also *DefineHome*)

APMIN – Set Minimum Analog Position

Sets the *Analog Position Control* mode’s minimum position to the current position.

APMAX – Set Maximum Analog Position

Sets the *Analog Position Control* mode’s maximum position to the current position.

STC – Set Startup Complete

Sets the *Startup Complete* flag in the *Status Log* and saves both the *Status Log* and *User Parameters* to non-volatile memory.

CurrentLimit

CurrentLimit is used by both the primary and secondary motion segments if enabled by the *Primary.Options* or *Secondary.Options* *ILIMIT* flag. The absolute value of the maximum current command allowed for a motion segment with the *ILIMIT* option enabled will be limited to the value specified by the MOVE's *CurrentLimit*.

Acceleration

Acceleration sets the maximum rate of change of velocity command allowed for the entire move motion.

TerminationSwitch

An active input event in the *IEG_MOVE_SWITCH* group will terminate the move segment if the *TSF* option is selected in the move segment's options.

NextMove

The *NextMove* register specifies the zero-based move number of a move that is to

Primary.Options

Secondary.Options

Options for both the primary and secondary motion segments are set their respective options bitmap register.

| | | | | | | | | | | | | | | | |
|----|-----------|-----------|-----------|----|------------|------------|-----------|---|---|-----------|---------------|---|-------------|---|---|
| | FP | FS | FI | | TSF | TSR | TI | | | VO | ILIMIT | | TYPE | | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

TYPE

The *TYPE* field encodes the type of motion profile executed by the motion segment.

0 Absolute Position

The motion segment will move to the specified position in the absolute reference frame.

1 Incremental Distance

The motion segment will move the specified distance from the segment's starting position.

2 Unlimited Positive Direction

Motion will execute in the positive direction until a termination condition is observed.

3 Unlimited Negative Direction

Motion will execute in the negative direction until a termination condition is observed.

4 Absolute Positive

The motion segment will move to the specified position in the absolute reference frame if the direction of motion is positive, otherwise the drive will stop.

5 Absolute Negative

The motion segment will move to the specified position in the absolute reference frame if the direction of motion is negative, otherwise the drive will stop.

6 (reserved)

7 (reserved)

These motion profile types are reserved.

ILIMIT

Limits the maximum current command during the motion segment to the MOVE's CurrentLimit parameter. When the move segment completes, the normal drive current limit is restored.

VO

If selected, the index velocity will be controlled via the analog velocity override option.

TI

Terminates the motion segment if the absolute value of feedback current reaches the MOVE's CurrentLimit. If a TSR or TSF option (below) has also been enabled to terminate the motion segment on a digital switch input, both current limit AND switch termination options must be fulfilled before the motion segment terminates.

TSR

Terminates the motion segment if any digital input switch specified in the MOVE's TerminationSwitch bitmap becomes active. A momentary (edge-sensitive) input switch becomes active when a rising edge of the input is observed AFTER the move segment is started. A maintained (level-sensitive) input switch fulfills the termination condition whenever it is observed to be ON during the move segment. If the ILIMIT option (above) has also been enabled to terminate the motion segment on a current limit condition, both current limit AND switch termination options must be fulfilled before the motion segment terminates.

TSF

Terminates the motion segment if any digital input switch specified in the MOVE's TerminationSwitch bitmap becomes inactive. A momentary (edge-sensitive) input switch becomes inactive when a falling edge of the input is observed *after* the move segment is started. A maintained (level-sensitive) input switch fulfills the termination condition whenever it is observed to be OFF during the move segment. If the *ILIMIT* option (above) has also been enabled to terminate the motion segment on a current limit condition, both current limit AND switch termination options must be fulfilled before the motion segment terminates.

FI

Generates a *MoveTermination* fault if the TI option flag is set and is the reason for the move segment's termination.

FS

Generates a *MoveTermination* fault if either the TSR or TSF option flag is set and is the reason for the move segment's termination. This option may be

FP

Generates a *MoveTermination* fault if the move segment has terminated due to reaching the target position (absolute moves) or completing the target distance (incremental moves). This option is normally used in conjunction with either the TI, TSR, or TSF options when either current or switch termination is expected to occur before achieving the move segment position (absolute moves) or completing the move segment distance (incremental moves).

Primary.Position**Secondary.Position**

Specifies the position or distance for move segment. This register is not required for motion segments specified as *Unlimited Positive Direction* or *Unlimited Negative Direction* motion types in the segment's option word.

Primary.Velocity**Secondary.Velocity**

Specifies the absolute value of the maximum velocity that will be commanded for the motion segment.

Appendix B – Modbus Register IDs

This appendix provides the full *MODBUS* register map ordered by register *MODBUS* identifier. The register map is divided for convenience into the following major sections:

- Status and Control Registers
- User Parameter Registers
- Mapped Value Registers
- Factory Parameter Registers
- Factory Identification Registers

Each table gives the register's *MODBUS* identifier (in both decimal and hexadecimal), name, data type, read-write accessibility, data size (number of 16-bit words), storage location, and brief description. The abbreviations used in the read-write accessibility (*Access*) and storage location (*Storage*) fields are defined in the tables below.

| Access Definitions | |
|--------------------|---------------------------------------|
| Abbreviation | Description |
| RO | Data is read-only (input register) |
| RW | Data is read-write (holding register) |

| Storage Definitions | |
|---------------------|--|
| Abbreviation | Description |
| RAM | Data is stored in RAM |
| ROM | Data is stored in flash read-only memory |
| UP | User parameter data in RAM initialized from and storable to non-volatile storage mirror |
| FP | Factory parameter data in RAM initialized from and storable to non-volatile storage mirror |
| SL | Status log data in RAM initialized from and auto-stored to non-volatile storage mirror |
| FL | Fault log data in RAM initialized from and auto-stored to non-volatile storage mirror |
| NONE | Data has no storage behind it (used for indirect mapped data) |

Status and Control Registers Table

See Appendix A for details on data Types

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|-----|----------|------------------------|-----------------|--------|------|---------|---|
| 2 | 0x0002 | System Status | UINT16 | RO | 30 | RAM | System status registers |
| 2 | 0x0002 | | UINT16 | RO | 2 | RAM | reserved |
| 4 | 0x0004 | Disables | FLAGS | RO | 1 | RAM | Disabling flags (internal) |
| 5 | 0x0005 | Faults | FAULT | RO | 1 | RAM | Fault status flags (all active) |
| 6 | 0x0006 | HardFaults | FAULT | RO | 1 | RAM | Active hard fault status flags |
| 7 | 0x0007 | SoftFaults | FAULT | RO | 1 | RAM | Active soft fault status flags (warnings) |
| 8 | 0x0008 | HallBattery | UVOLT16 | RO | 1 | RAM | ABS Hall Board battery voltage [11.5 V] |
| 9 | 0x0009 | | UINT16 | RO | 1 | RAM | reserved |
| 10 | 0x000A | BoardTemp | INT32 | RO | 2 | RAM | Filtered PCB temperature [11.21 DEG C] |
| 12 | 0x000C | | UINT16 | RO | 2 | RAM | reserved |
| 14 | 0x000E | ActuatorTemp | INT32 | RO | 2 | RAM | Filtered actuator temperature [11.21 DEG C] |
| 16 | 0x0010 | MinScanTime | UINT32 | RO | 2 | RAM | Minimum background scan time [SYSCLK] |
| 18 | 0x0012 | MaxScanTime | UINT32 | RO | 2 | RAM | Maximum background scan time [SYSCLK] |
| 20 | 0x0014 | AvgScanTime | UINT32 | RO | 2 | RAM | Average background scan time [SYSCLK] |
| 22 | 0x0016 | Hs_temp | INT32 | RO | 2 | RAM | Filtered head sink temperature |
| 24 | 0x0018 | Faults32 | UINT32 | RO | 2 | RAM | Fault status flags (all active) - 32 faults |
| 26 | 0x001A | Hardfaults32 | UINT32 | RO | 2 | RAM | Active hard fault status flags – 32 faults |
| 28 | 0x001B | Softfaults32 | UINT32 | RO | 2 | RAM | Active soft fault status flags – 32 faults |
| 30 | 0x001E | Command Status | UINT16 | RO | 64 | RAM | Command status registers |
| 30 | 0x001E | Command.SubMode | FLAGS | RO | 1 | RAM | Active command sub-mode |
| 31 | 0x001F | Command.Mode | OPMODE | RO | 1 | RAM | Active command mode |
| 32 | 0x0020 | Command.Flags | FLAGS | RO | 1 | RAM | Internal command mode flags |
| 33 | 0x0021 | Command.Move | UINT16 | RO | 1 | RAM | Active move number |
| 34 | 0x0022 | Command.PlimitMinus | POS32 | RO | 2 | RAM | Active position limit (-) |
| 36 | 0x0024 | Command.PlimitPlus | POS32 | RO | 2 | RAM | Active position limit (+) |
| 38 | 0x0026 | Command.PlimitVelocity | INT32 | RO | 2 | RAM | Active position limit velocity |
| 40 | 0x0028 | Command.IlimitMinus | CUR32 | RO | 2 | RAM | Active current command limit (-) |
| 42 | 0x002A | Command.IlimitPlus | CUR32 | RO | 2 | RAM | Active current command limit (+) |
| 44 | 0x002C | Command.Vlimit | INT32 | RO | 2 | RAM | Active velocity limit |
| 46 | 0x002E | Command.Alimit | UACC32 | RO | 2 | RAM | Active acceleration limit |
| 48 | 0x0030 | Command.MoveFlags | FLAGS | RO | 1 | RAM | Active position limit (+) |
| 49 | 0x0031 | | UINT16 | RO | 1 | RAM | reserved |
| 50 | 0x0032 | Command.Ptarget | POS32 | RO | 2 | RAM | Active position target |
| 52 | 0x0034 | Command.Vtarget | INT32 | RO | 2 | RAM | Active velocity target |
| 54 | 0x0036 | Command.Id | CUR32 | RO | 2 | RAM | Direct current command |
| 56 | 0x0038 | Command.Iq | CUR32 | RO | 2 | RAM | Quadrature current command |
| 58 | 0x003A | Command.Vd | VOLT32 | RO | 2 | RAM | Direct voltage command |
| 60 | 0x003C | Command.Vq | VOLT32 | RO | 2 | RAM | Quadrature voltage command |
| 62 | 0x003E | D_limit | UACC32 | RO | 2 | RAM | Active deceleration limit |
| 100 | 0x0064 | I/O Status | UINT16 | RO | 42 | RAM | Digital I/O status registers |
| 100 | 0x0064 | Inputs | FLAGS | RO | 1 | RAM | Active input status |
| 101 | 0x0065 | Outputs | FLAGS | RO | 1 | RAM | Active output status |
| 102 | 0x0066 | HwInputs | FLAGS | RO | 1 | RAM | Hardware inputs (before inhibits/polarity) |
| 103 | 0x0067 | HwOutputs | FLAGS | RO | 1 | RAM | Hardware outputs (after inhibits/polarity) |
| 104 | 0x0068 | OutputEvents.0 | OEG_STATUS | RO | 1 | RAM | Active output status events |
| 105 | 0x0069 | OutputEvents.1 | OEG_MOTION | RO | 1 | RAM | |
| 106 | 0x006A | OutputEvents.2 | OEG_CONTROL | RO | 1 | RAM | |
| 107 | 0x006B | OutputEvents.3 | OEG_MOVE_ACTIVE | RO | 1 | RAM | |
| 108 | 0x006C | OutputEvents.4 | OEG_MOVE_IN_POS | RO | 1 | RAM | |
| 109 | 0x006D | | UINT16 | RO | 1 | RAM | reserved |
| 110 | 0x006E | InputEvents.0 | IEG_MODE | RO | 1 | RAM | Active input events |
| 111 | 0x006F | InputEvents.1 | IEG_MOTION | RO | 1 | RAM | |
| 112 | 0x0070 | InputEvents.2 | IEG_MOVE_LEVEL | RO | 1 | RAM | |
| 113 | 0x0071 | InputEvents.3 | IEG_MOVE_EDGE | RO | 1 | RAM | |
| 114 | 0x0072 | InputEvents.4 | IEG_MOVE_TEACH | RO | 1 | RAM | |
| 115 | 0x0073 | InputEvents.5 | IEG_MOVE_SELECT | RO | 1 | RAM | |
| 116 | 0x0074 | InputEvents.6 | IEG_MOVE_SWITCH | RO | 1 | RAM | |
| 117 | 0x0075 | | UINT16 | RO | 1 | RAM | reserved |
| 118 | 0x0076 | LatchedInputEvents | UINT16 | RO | 8 | RAM | Latched input event status |
| 126 | 0x007E | RisingInputEvents | UINT16 | RO | 8 | RAM | Rising edge input event status |
| 134 | 0x0086 | FallingInputEvents | UINT16 | RO | 8 | RAM | Falling edge input event status |
| 200 | 0x00C8 | Analog Command Status | UINT16 | RO | 6 | RAM | Analog command mode status registers |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|-----|----------|---------------------------|--------|--------|------|---------|--|
| 200 | 0x00C8 | AnalogPositionTarget | POS32 | RO | 2 | RAM | Target position for analog position mode |
| 202 | 0x00CA | AnalogVelocityTarget | VEL32 | RO | 2 | RAM | Target velocity for analog velocity mode |
| 204 | 0x00CC | AnalogCurrentTarget | CUR32 | RO | 2 | RAM | Target current for analog current mode |
| 220 | 0x00DC | Analog Input 1 | UINT16 | RO | 20 | RAM | Analog Input 1 status registers |
| 220 | 0x00DC | | UINT16 | RO | 1 | RAM | reserved |
| 221 | 0x00DD | AdcInstantaneous | UINT16 | RO | 1 | RAM | Unfiltered ADC [0x0000..0xFFF0] |
| 222 | 0x00DE | AdcFiltered | INT32 | RO | 2 | RAM | Filtered ADC (0..1) [2.30 ADC] |
| 224 | 0x00E0 | UserFiltered | INT32 | RO | 2 | RAM | Filtered input [6.26 user units] |
| 226 | 0x00E2 | UseableRange | INT32 | RO | 2 | RAM | Fraction of useable range ([0..1] [2.30]) |
| 228 | 0x00E4 | Dudx | INT32 | RO | 2 | RAM | du/dx scale factor [10.22] |
| 230 | 0x00E6 | B | INT32 | RO | 2 | RAM | y-axis intercept offset [6.26 user units] |
| 232 | 0x00E8 | RangeMinimum | INT32 | RO | 2 | RAM | Minimum useable range (0..1) [2.30 ADC] |
| 234 | 0x00EA | RangeMaximum | INT32 | RO | 2 | RAM | Maximum useable range (0..1) [2.30 ADC] |
| 236 | 0x00EC | | UINT16 | RO | 4 | RAM | reserved |
| 240 | 0x00F0 | Analog Input 2 | UINT16 | RO | 20 | RAM | Analog Input 2 status registers |
| 240 | 0x00F0 | | UINT16 | RO | 1 | RAM | reserved |
| 241 | 0x00F1 | AdcInstantaneous | UINT16 | RO | 1 | RAM | Unfiltered ADC [0x0000..0xFFF0] |
| 242 | 0x00F2 | AdcFiltered | INT32 | RO | 2 | RAM | Filtered ADC (0..1) [2.30 ADC] |
| 244 | 0x00F4 | UserFiltered | INT32 | RO | 2 | RAM | Filtered input [6.26 user units] |
| 246 | 0x00F6 | UseableRange | INT32 | RO | 2 | RAM | Fraction of useable range ([0..1] [2.30]) |
| 248 | 0x00F8 | Dudx | INT32 | RO | 2 | RAM | du/dx scale factor [10.22] |
| 250 | 0x00FA | B | INT32 | RO | 2 | RAM | y-axis intercept offset [6.26 user units] |
| 252 | 0x00FC | RangeMinimum | INT32 | RO | 2 | RAM | Minimum useable range (0..1) [2.30 ADC] |
| 254 | 0x00FE | RangeMaximum | INT32 | RO | 2 | RAM | Maximum useable range (0..1) [2.30 ADC] |
| 256 | 0x0100 | | UINT16 | RO | 4 | RAM | reserved |
| 260 | 0x0104 | Analog Input 3 (reserved) | UINT16 | RO | 20 | RAM | Analog Input 3 status registers |
| 280 | 0x0118 | Analog Input 4 (reserved) | UINT16 | RO | 20 | RAM | Analog Input 4 status registers |
| 340 | 0x0154 | Velocity Status | UINT16 | RO | 48 | RAM | Velocity/Position loop status registers |
| 340 | 0x0154 | Vcontrol | CUR32 | RO | 2 | RAM | Controller current command out [9.23 AMPS] |
| 342 | 0x0156 | RevAngleLast | INT32 | RO | 2 | RAM | Last position rev angle [0.32 REV] |
| 344 | 0x0158 | VfeedbackUser | VEL32 | RO | 2 | RAM | Feedback velocity [8.24 RPS] |
| 346 | 0x015A | VcommandUser | VEL32 | RO | 2 | RAM | Command velocity [8.24 RPS] |
| 348 | 0x015C | VerrorUser | VEL32 | RO | 2 | RAM | Velocity error [8.24 RPS] |
| 350 | 0x015E | VerrorMinUser | VEL32 | RO | 2 | RAM | Minimum velocity error observed [8.24 RPS] |
| 352 | 0x0160 | VerrorMaxUser | VEL32 | RO | 2 | RAM | Maximum velocity error observed [8.24 RPS] |
| 354 | 0x0162 | | UINT16 | RO | 2 | RAM | reserved |
| 356 | 0x0164 | Vdisplay | VEL32 | RO | 2 | RAM | Filtered display velocity [8.24 RPS] |
| 358 | 0x0166 | | UINT16 | RO | 2 | RAM | reserved |
| 360 | 0x0168 | Vfeedback | VEL32 | RO | 2 | RAM | Internal velocity f/b [0.32 REV/UPDATE] |
| 362 | 0x016A | Vcommand | VEL32 | RO | 2 | RAM | Internal velocity cmd [0.32 REV/UPDATE] |
| 364 | 0x016C | | UINT16 | RO | 14 | RAM | reserved |
| 378 | 0x017A | Pfeedback | POS32 | RO | 2 | RAM | Feedback position [16.16 REVS] |
| 380 | 0x017C | Pcommand | POS32 | RO | 2 | RAM | Command position [16.16 REVS] |
| 382 | 0x017E | Perror | POS32 | RO | 2 | RAM | Position error [16.16 REVS] |
| 384 | 0x0180 | PerrorMin | POS32 | RO | 2 | RAM | Min position error observed [16.16 REVS] |
| 386 | 0x0182 | PerrorMax | POS32 | RO | 2 | RAM | Max position error observed [16.16 REVS] |
| 388 | 0x0184 | Execution_time_min | UINT32 | RO | 1 | RAM | |
| 389 | 0x0185 | Execution_time_max | UINT32 | RO | 1 | RAM | |
| 400 | 0x0190 | Scope Status | UINT16 | RO | 16 | RAM | Digital oscilloscope status registers |
| 400 | 0x0190 | Status | FLAGS | RO | 1 | RAM | Scope status flags |
| 401 | 0x0191 | RecordCount | UINT16 | RO | 1 | RAM | Number of records in buffer |
| 402 | 0x0192 | MaxRecords | UINT16 | RO | 1 | RAM | Number of records buffer can hold |
| 403 | 0x0193 | RecordSize | UINT16 | RO | 1 | RAM | Size of single record [WORDS] |
| 404 | 0x0194 | BufferSize | UINT16 | RO | 1 | RAM | Total buffer size [WORDS] |
| 405 | 0x0195 | Timestamp | UINT16 | RO | 1 | RAM | Free-running timestamp [UPDATES] |
| 406 | 0x0196 | Channel1 | INT32 | RO | 2 | RAM | Last Channel 1 value |
| 408 | 0x0198 | Channel2 | INT32 | RO | 2 | RAM | Last Channel 2 value |
| 410 | 0x019A | Channel3 | INT32 | RO | 2 | RAM | Last Channel 3 value |
| 412 | 0x019C | Channel4 | INT32 | RO | 2 | RAM | Last Channel 4 value |
| 414 | 0x019E | Trigger | INT32 | RO | 2 | RAM | Current trigger level |
| 500 | 0x01F4 | Current Loop Status | UINT16 | RO | 87 | RAM | Current loop status registers |
| 500 | 0x01F4 | RawEangle | INT32 | RO | 2 | RAM | Raw electrical angle from position rev angle |
| 502 | 0x01F6 | Eangle | INT32 | RO | 2 | RAM | Electrical angle (commutation) |
| 504 | 0x01F8 | Esine | INT32 | RO | 2 | RAM | SIN(Eangle) |
| 506 | 0x01FA | Ecosine | INT32 | RO | 2 | RAM | COS(Eangle) |
| 508 | 0x01FC | IR | CUR32 | RO | 2 | RAM | R phase current [9.23 AMPS] |
| 510 | 0x01FE | IS | CUR32 | RO | 2 | RAM | S phase current [9.23 AMPS] |
| 512 | 0x0200 | IT | CUR32 | RO | 2 | RAM | T phase current [9.23 AMPS] (calculated) |
| 514 | 0x0202 | Id | CUR32 | RO | 2 | RAM | D leg current (static frame) [9.23 AMPS] |
| 516 | 0x0204 | Iq | CUR32 | RO | 2 | RAM | Q leg current (static frame) [9.23 AMPS] |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|-----|----------|--------------------------|--------|--------|------|---------|--|
| 518 | 0x0206 | IdFeedback | CUR32 | RO | 2 | RAM | D leg current (rotating frame) [9.23 AMPS] |
| 520 | 0x0208 | IqFeedback | CUR32 | RO | 2 | RAM | Q leg current (rotating frame) [9.23 AMPS] |
| 522 | 0x020A | IdCommand | CUR32 | RO | 2 | RAM | D leg current cmd [9.23 AMPS] |
| 524 | 0x020C | IqCommand | CUR32 | RO | 2 | RAM | Q leg current cmd [9.23 AMPS] |
| 526 | 0x020E | Imagnitude | UCUR32 | RO | 2 | RAM | Magnitude of current vector [9.23 AMPS] |
| 528 | 0x0210 | VdCommand | VOLT32 | RO | 2 | RAM | D leg voltage cmd (rotating frame) [11.21 V] |
| 530 | 0x0212 | VqCommand | VOLT32 | RO | 2 | RAM | Q leg voltage cmd (rotating frame) [11.21 V] |
| 532 | 0x0214 | Vd | VOLT32 | RO | 2 | RAM | D leg voltage cmd (static frame) [11.21 V] |
| 534 | 0x0216 | Vq | VOLT32 | RO | 2 | RAM | Q leg voltage cmd (static frame) [11.21 V] |
| 536 | 0x0218 | Vr | INT32 | RO | 2 | RAM | R phase voltage cmd [1.31 full scale] |
| 538 | 0x021A | Vs | INT32 | RO | 2 | RAM | S phase voltage cmd [1.31 full scale] |
| 540 | 0x021C | Vt | INT32 | RO | 2 | RAM | T phase voltage cmd [1.31 full scale] |
| 542 | 0x021E | Qharmonic | CUR32 | RO | 2 | RAM | Q harmonic feed-forward [9.23 AMPS] |
| 544 | 0x0220 | IdError | INT32 | RO | 2 | RAM | D leg controller error |
| 546 | 0x0222 | IqError | INT32 | RO | 2 | RAM | Q leg controller error |
| 548 | 0x0224 | Tr | INT32 | RO | 2 | RAM | R phase duty cycle [0.0x7FFFFFFF] |
| 550 | 0x0226 | Ts | INT32 | RO | 2 | RAM | S phase duty cycle [0.0x7FFFFFFF] |
| 552 | 0x0228 | Tt | INT32 | RO | 2 | RAM | T phase duty cycle [0.0x7FFFFFFF] |
| 554 | 0x022A | PwmBasePeriod | UINT16 | RO | 1 | RAM | Base period divisor [TBCLK counts] |
| 555 | 0x022B | PwmPeriod | UINT16 | RO | 1 | RAM | Modulated period divisor [TBCLK counts] |
| 556 | 0x022C | | UINT16 | RO | 4 | RAM | reserved |
| 560 | 0x0230 | Vmagnitude | VOLT32 | RO | 2 | RAM | Magnitude of voltage command vector |
| 562 | 0x0232 | | UINT16 | RO | 2 | RAM | reserved |
| 564 | 0x0234 | Icontinuous | UCUR32 | RO | 2 | RAM | Filtered continuous current |
| 566 | 0x0236 | Idisplay | CUR32 | RO | 2 | RAM | Filtered IqFeedback for display |
| 568 | 0x0238 | VbusInstantaneous | VOLT32 | RO | 2 | RAM | Instantaneous bus voltage |
| 570 | 0x023A | Vbus | VOLT32 | RO | 2 | RAM | Filtered bus voltage |
| 572 | 0x023C | PowerInstantaneous | INT32 | RO | 2 | RAM | Instantaneous power |
| 574 | 0x023E | Power | INT32 | RO | 2 | RAM | Filtered power |
| 576 | 0x0240 | MaxImagnitude | UCUR32 | RO | 2 | RAM | Maximum Imagnitude observed |
| 578 | 0x0242 | MaxVbus | VOLT32 | RO | 2 | RAM | Maximum Vbus observed |
| 580 | 0x0244 | MinExecutionTime | UINT16 | RO | 1 | RAM | Minimum execution time [SYSCLK] |
| 581 | 0x0245 | MaxExecutionTime | UINT16 | RO | 1 | RAM | Maximum execution time [SYSCLK] |
| 582 | 0x0246 | Shunt_energy_available | INT32 | RO | 2 | RAM | Shunt energy available |
| 584 | 0x0248 | Shunt_on | INT16 | RO | 1 | RAM | Shunt on point |
| 585 | 0x0249 | Shunt_off | INT16 | RO | 1 | RAM | Shunt off point |
| 586 | 0x250 | High_voltage_trip | INT16 | RO | 1 | RAM | Runtime high voltage trip point |
| 600 | 0x0258 | Position Status | UINT16 | RO | 36 | RAM | Position status registers |
| 600 | 0x0258 | RevAngle | INT32 | RO | 2 | RAM | Actuator rev angle |
| 602 | 0x025A | HallGain | INT32 | RO | 2 | RAM | Tracking filter accel gain |
| 604 | 0x025C | HallDamping | INT32 | RO | 2 | RAM | Tracking filter damping gain |
| 606 | 0x025E | HallError | INT32 | RO | 2 | RAM | Tracking filter error |
| 608 | 0x0260 | HallVelocity | INT32 | RO | 2 | RAM | Tracking filter velocity |
| 610 | 0x0262 | HallRevAngle | INT32 | RO | 2 | RAM | Tracking rev angle |
| 612 | 0x0264 | SineIn | INT32 | RO | 2 | RAM | SIN(input position angle) |
| 614 | 0x0266 | CosineIn | INT32 | RO | 2 | RAM | COS(input position angle) |
| 616 | 0x0268 | SineOut | INT32 | RO | 2 | RAM | SIN(estimated position angle) |
| 618 | 0x026A | CosineOut | INT32 | RO | 2 | RAM | COS(estimated position angle) |
| 620 | 0x026C | SineMin | INT16 | RO | 1 | RAM | Minimum SineIn observed |
| 621 | 0x026D | SineMax | INT16 | RO | 1 | RAM | Maximum SineIn observed |
| 622 | 0x026E | CosineMin | INT16 | RO | 1 | RAM | Minimum CosineIn observed |
| 623 | 0x026F | CosineMax | INT16 | RO | 1 | RAM | Maximum CosineIn observed |
| 624 | 0x0270 | EncoderCount | INT32 | RO | 2 | RAM | Free-running count from encoder inputs |
| 626 | 0x0272 | UVW | UINT16 | RO | 1 | RAM | UVW commutation position (bit 0 = U) |
| 627 | 0x0273 | PosTrackingError | INT16 | RO | 1 | RAM | Position tracking error |
| 628 | 0x0274 | PosTableCorrection | INT32 | RO | 2 | RAM | Position feedback correction from table |
| 630 | 0x0276 | Eoffset | INT32 | RO | 2 | RAM | Electrical angle offset |
| 632 | 0x0278 | AbsHallPosition | INT16 | RO | 1 | RAM | Absolute Hall board position |
| 633 | 0x0279 | AbsHallStatus | FLAGS | RO | 1 | RAM | Absolute Hall board status flags |
| 634 | 0x027A | AbsHallRevision | UINT16 | RO | 1 | RAM | Absolute Hall board revision |
| 635 | 0x027B | Status | FLAGS | RO | 1 | RAM | Position status flags |
| 700 | 0x02BC | Analog Output 1 Status | UINT16 | RO | 4 | RAM | Analog Output 1 status registers |
| 700 | 0x02BC | AnalogOutput.1.Vfiltered | INT32 | RO | 2 | RAM | Filtered output variable |
| 702 | 0x02BE | AnalogOutput.1.DacOutput | UINT16 | RO | 1 | RAM | DAC output variable |
| 703 | 0x02BF | AnalogOutput.1.Fraction | UINT16 | RO | 1 | RAM | Fraction of variable |
| 704 | 0x02C0 | Analog Output 2 Status | UINT16 | RO | 4 | RAM | Analog Output 2 status registers |
| 704 | 0x02C0 | AnalogOutput.2.Vfiltered | INT32 | RO | 2 | RAM | Filtered output variable |
| 706 | 0x02C2 | AnalogOutput.2.DacOutput | UINT16 | RO | 1 | RAM | DAC output variable |
| 707 | 0x02C3 | AnalogOutput.2.Fraction | UINT16 | RO | 1 | RAM | Fraction of variable |
| 732 | 0x02DC | Status Log | UINT16 | RO | 32 | SL | Status Log |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|-----|----------|----------------------------|---------|--------|------|---------|---------------------------------------|
| 732 | 0x02DC | CRC | UINT16 | RO | 1 | SL | Internal CRC check word |
| 733 | 0x02DD | | UINT16 | RO | 1 | SL | reserved |
| 734 | 0x02DE | Flags | FLAGS | RO | 1 | SL | Status log flags |
| 735 | 0x02DF | PowerUpCount | UINT16 | RO | 1 | SL | Number of times drive has powered up |
| 736 | 0x02E0 | PwmRunTime | UINT32 | RO | 2 | SL | Total time PWM has been active |
| 738 | 0x02E2 | AbsPositionOffset | POS32 | RO | 2 | SL | Absolute position offset |
| 740 | 0x02E4 | MaxCurrent | UCUR32 | RO | 2 | SL | Max current magnitude observed |
| 742 | 0x02E6 | MaxVbus | UVOLT32 | RO | 2 | SL | Max bus voltage observed |
| 744 | 0x02E8 | MaxBoardTemp | INT32 | RO | 2 | SL | Max PCB temperature observed |
| 746 | 0x02EA | MaxActuatorTemp | INT32 | RO | 2 | SL | Max actuator temperature observed |
| 748 | 0x02EC | | UINT16 | RO | 16 | SL | reserved |
| 764 | 0x02FC | Fault Log | UINT16 | RO | 1 | FL | Fault Log |
| 764 | 0x02FC | CRC | UINT16 | RO | 1 | FL | Internal CRC check word |
| 765 | 0x02FD | | UINT16 | RO | 1 | FL | reserved |
| 766 | 0x02FE | | UINT16 | RO | 16 | FL | reserved |
| 782 | 0x030E | FaultCount.0 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.0 |
| 783 | 0x030F | FaultCount.1 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.1 |
| 784 | 0x0310 | FaultCount.2 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.2 |
| 785 | 0x0311 | FaultCount.3 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.3 |
| 786 | 0x0312 | FaultCount.4 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.4 |
| 787 | 0x0313 | FaultCount.5 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.5 |
| 788 | 0x0314 | FaultCount.6 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.6 |
| 789 | 0x0315 | FaultCount.7 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.7 |
| 790 | 0x0316 | FaultCount.8 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.8 |
| 791 | 0x0317 | FaultCount.9 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.9 |
| 792 | 0x0318 | FaultCount.10 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.10 |
| 793 | 0x0319 | FaultCount.11 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.11 |
| 794 | 0x031A | FaultCount.12 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.12 |
| 795 | 0x031B | FaultCount.13 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.13 |
| 796 | 0x031C | FaultCount.14 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.14 |
| 797 | 0x031D | FaultCount.15 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.15 |
| 798 | 0x031E | PowerUpCount.0 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.0 fault |
| 799 | 0x031F | PowerUpCount.1 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.1 fault |
| 800 | 0x0320 | PowerUpCount.2 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.2 fault |
| 801 | 0x0321 | PowerUpCount.3 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.3 fault |
| 802 | 0x0322 | PowerUpCount.4 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.4 fault |
| 803 | 0x0323 | PowerUpCount.5 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.5 fault |
| 804 | 0x0324 | PowerUpCount.6 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.6 fault |
| 805 | 0x0325 | PowerUpCount.7 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.7 fault |
| 806 | 0x0326 | PowerUpCount.8 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.8 fault |
| 807 | 0x0327 | PowerUpCount.9 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.9 fault |
| 808 | 0x0328 | PowerUpCount.10 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.10 fault |
| 809 | 0x0329 | PowerUpCount.11 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.11 fault |
| 810 | 0x032A | PowerUpCount.12 | UINT16 | RO | 1 | FL | Power-up count of last FAULT.12 fault |
| 811 | 0x032B | PowerUpCount.13 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.13 fault |
| 812 | 0x032C | PowerUpCount.14 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.14 fault |
| 813 | 0x032D | PowerUpCount.15 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.15 fault |
| 814 | 0x032E | PwmTime.0 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.0 fault |
| 816 | 0x0330 | PwmTime.1 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.1 fault |
| 818 | 0x0332 | PwmTime.2 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.2 fault |
| 820 | 0x0334 | PwmTime.3 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.3 fault |
| 822 | 0x0336 | PwmTime.4 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.4 fault |
| 824 | 0x0338 | PwmTime.5 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.5 fault |
| 826 | 0x033A | PwmTime.6 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.6 fault |
| 828 | 0x033C | PwmTime.7 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.7 fault |
| 830 | 0x033E | PwmTime.8 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.8 fault |
| 832 | 0x0340 | PwmTime.9 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.9 fault |
| 834 | 0x0342 | PwmTime.10 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.10 fault |
| 836 | 0x0344 | PwmTime.11 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.11 fault |
| 838 | 0x0346 | PwmTime.12 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.12 fault |
| 840 | 0x0348 | PwmTime.13 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.13 fault |
| 842 | 0x034A | PwmTime.14 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.14 fault |
| 844 | 0x034C | PwmTime.15 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.15 fault |
| 846 | 0x034E | RecentFault.0.ID | FAULT | RO | 1 | FL | FAULT ID of most recent fault |
| 847 | 0x034F | RecentFault.0.PowerUpCount | UINT16 | RO | 1 | FL | Power up count of most recent fault |
| 848 | 0x0350 | RecentFault.0.RunTime | UINT32 | RO | 2 | FL | PWM run time of most recent fault |
| 850 | 0x0352 | RecentFault.1.ID | FAULT | RO | 1 | FL | FAULT ID of most recent fault |
| 851 | 0x0353 | RecentFault.1.PowerUpCount | UINT16 | RO | 1 | FL | Power up count of most recent fault |
| 852 | 0x0354 | RecentFault.1.RunTime | UINT32 | RO | 2 | FL | PWM run time of most recent fault |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|----------------------------|--------|-----------------|------|---------|---|
| 854 | 0x0356 | RecentFault.2.ID | FAULT | RO | 1 | FL | |
| 855 | 0x0357 | RecentFault.2.PowerUpCount | UINT16 | RO | 1 | FL | |
| 856 | 0x0358 | RecentFault.2.RunTime | UINT32 | RO | 2 | FL | |
| 858 | 0x035A | RecentFault.3.ID | FAULT | RO | 1 | FL | |
| 859 | 0x035B | RecentFault.3.PowerUpCount | UINT16 | RO | 1 | FL | |
| 860 | 0x035C | RecentFault.3.RunTime | UINT32 | RO | 2 | FL | |
| 862 | 0x035E | RecentFault.4.ID | FAULT | RO | 1 | FL | |
| 863 | 0x035F | RecentFault.4.PowerUpCount | UINT16 | RO | 1 | FL | |
| 864 | 0x0360 | RecentFault.4.RunTime | UINT32 | RO | 2 | FL | |
| 866 | 0x0362 | RecentFault.5.ID | FAULT | RO | 1 | FL | |
| 867 | 0x0363 | RecentFault.5.PowerUpCount | UINT16 | RO | 1 | FL | |
| 868 | 0x0364 | RecentFault.5.RunTime | UINT32 | RO | 2 | FL | |
| 870 | 0x0366 | RecentFault.6.ID | FAULT | RO | 1 | FL | |
| 871 | 0x0367 | RecentFault.6.PowerUpCount | UINT16 | RO | 1 | FL | |
| 872 | 0x0368 | RecentFault.6.RunTime | UINT32 | RO | 2 | FL | |
| 874 | 0x036A | RecentFault.7.ID | FAULT | RO | 1 | FL | |
| 875 | 0x036B | RecentFault.7.PowerUpCount | UINT16 | RO | 1 | FL | |
| 876 | 0x036C | RecentFault.7.RunTime | UINT32 | RO | 2 | FL | |
| 878 | 0x036E | RecentFault.8.ID | FAULT | RO | 1 | FL | |
| 879 | 0x036F | RecentFault.8.PowerUpCount | UINT16 | RO | 1 | FL | |
| 880 | 0x0370 | RecentFault.8.RunTime | UINT32 | RO | 2 | FL | |
| 882 | 0x0372 | RecentFault.9.ID | FAULT | RO | 1 | FL | FAULT ID of least recent fault |
| 883 | 0x0373 | RecentFault.9.PowerUpCount | UINT16 | RO | 1 | FL | Power up count of least recent fault |
| 884 | 0x0374 | RecentFault.9.RunTime | UINT32 | RO | 2 | FL | PWM run time of least recent fault |
| 886 | 0x0376 | | UINT16 | RO | 6 | FL | reserved |
| 900 | 0x0384 | DSP Analog Input Channels | UINT16 | RO | 16 | RAM | DSP ADC inputs |
| 900 | 0x0384 | ADC0 | UINT16 | RO | 1 | RAM | DSP ADC Channel 0 |
| 901 | 0x0385 | ADC1 | UINT16 | RO | 1 | RAM | DSP ADC Channel 1 |
| 902 | 0x0386 | ADC2 | UINT16 | RO | 1 | RAM | DSP ADC Channel 2 |
| 903 | 0x0387 | ADC3 | UINT16 | RO | 1 | RAM | DSP ADC Channel 3 |
| 904 | 0x0388 | ADC4 | UINT16 | RO | 1 | RAM | DSP ADC Channel 4 |
| 904 | 0x0389 | ADC5 | UINT16 | RO | 1 | RAM | DSP ADC Channel 5 |
| 906 | 0x038A | ADC6 | UINT16 | RO | 1 | RAM | DSP ADC Channel 6 |
| 907 | 0x038B | ADC7 | UINT16 | RO | 1 | RAM | DSP ADC Channel 7 |
| 908 | 0x038C | ADC8 | UINT16 | RO | 1 | RAM | DSP ADC Channel 8 |
| 909 | 0x038D | ADC9 | UINT16 | RO | 1 | RAM | DSP ADC Channel 9 |
| 910 | 0x038E | ADC10 | UINT16 | RO | 1 | RAM | DSP ADC Channel 10 |
| 911 | 0x038F | ADC11 | UINT16 | RO | 1 | RAM | DSP ADC Channel 11 |
| 912 | 0x0390 | ADC12 | UINT16 | RO | 1 | RAM | DSP ADC Channel 12 |
| 913 | 0x0391 | ADC13 | UINT16 | RO | 1 | RAM | DSP ADC Channel 13 |
| 914 | 0x0392 | ADC14 | UINT16 | RO | 1 | RAM | DSP ADC Channel 14 |
| 915 | 0x0393 | ADC15 | UINT16 | RO | 1 | RAM | DSP ADC Channel 15 |
| 4000 | 0x0FA0 | System Command | UINT16 | RW | 2 | RAM | System control registers |
| 4000 | 0x0FA0 | SecurityKey | UINT16 | RW | 1 | RAM | Security key |
| 4001 | 0x0FA1 | Command | FLAGS | RW | 1 | RAM | System command / response flags |
| 4002 | 0x0FA2 | Mapped Write Monitor | UINT16 | RW | 4 | RAM | Mapped write diagnostics registers |
| 4002 | 0x0FA2 | MonitorID | UINT16 | RW | 1 | RAM | MODBUS ID of mapped variable to monitor |
| 4003 | 0x0FA3 | MonitorExpectedValue | UINT16 | RW | 1 | RAM | Expected value to be written variable |
| 4004 | 0x0FA4 | MonitorLatchedValue | UINT16 | RW | 1 | RAM | Last unexpected value written |
| 4005 | 0x0FA5 | MonitorCount | UINT16 | RW | 1 | RAM | Count of unexpected values written |
| 4100 | 0x1004 | Scope Control | UINT16 | RW | 16 | RAM | Digital oscilloscope control registers |
| 4100 | 0x1004 | Channel1.Variable | UINT16 | RW | 1 | RAM | Channel 1 variable ID |
| 4101 | 0x1005 | Channel1.Flags | FLAGS | RW | 1 | RAM | Channel 1 variable flags |
| 4102 | 0x1006 | Channel2.Variable | UINT16 | RW | 1 | RAM | Channel 2 variable ID |
| 4103 | 0x1007 | Channel2.Flags | FLAGS | RW | 1 | RAM | Channel 2 variable flags |
| 4104 | 0x1008 | Channel3.Variable | UINT16 | RW | 1 | RAM | Channel 3 variable ID |
| 4105 | 0x1009 | Channel3.Flags | FLAGS | RW | 1 | RAM | Channel 3 variable flags |
| 4106 | 0x100A | Channel4.Variable | UINT16 | RW | 1 | RAM | Channel 4 variable ID |
| 4107 | 0x100B | Channel4.Flags | FLAGS | RW | 1 | RAM | Channel 4 variable flags |
| 4108 | 0x100C | TriggerVariable | UINT16 | RW | 1 | RAM | Trigger variable ID |
| 4109 | 0x100D | TriggerFlags | FLAGS | RW | 1 | RAM | Trigger variable flags |
| 4110 | 0x100E | TriggerLevel | INT32 | RW | 2 | RAM | Trigger level |
| 4112 | 0x1010 | PreTrigger | UINT16 | RW | 1 | RAM | Pre-trigger buffer size [UPDATES] |
| 4113 | 0x1011 | | UINT16 | RW | 1 | RAM | Reserved |
| 4114 | 0x1012 | UpdateRate | UINT16 | RW | 1 | RAM | Update rate [SYS_TICKS] |
| 4115 | 0x1013 | Control | FLAGS | RW | 1 | RAM | Control command flags |
| 4200 | 0x1068 | Comms Diagnostics | UINT16 | RW | 8 | RAM | Communication status registers |
| 4200 | 0x1068 | SCIA_errors | FLAGS | RW | 1 | RAM | SCI-A (RS485) error flags |
| 4201 | 0x1069 | SCIB_errors | FLAGS | RW | 1 | RAM | SCI-B (Ethernet) error flags |
| 4202 | 0x106A | NetworkStatus | FLAGS | RW ² | 1 | RAM | EXPORT network status |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|-------------------------|--------|-----------------|------|---------|---|
| 4203 | 0x106B | ModuleStatus | FLAGS | RW ² | 1 | RAM | EXPORT module status |
| 4204 | 0x106C | MacAddress1 | UINT16 | RW ² | 1 | RAM | MAC address 1 (set by XPORT) |
| 4205 | 0x106D | MacAddress2 | UINT16 | RW ² | 1 | RAM | MAC address 2 (set by XPORT) |
| 4206 | 0x106E | MacAddress3 | UINT16 | RW ² | 1 | RAM | MAC address 3 (set by XPORT) |
| 4207 | 0x106F | | UINT16 | RW | 1 | RAM | Reserved |
| 4308 | 0x10D4 | Ethernet Address Mirror | UINT16 | RW | 6 | RAM | Ethernet parameter mirror |
| 4208 | 0x10D4 | IP | UINT32 | RW ¹ | 2 | RAM | IP address (set by XPORT) |
| 4210 | 0x10D6 | SUBNET | UINT32 | RW ¹ | 2 | RAM | SUBNET address (set by XPORT) |
| 4212 | 0x10D8 | GATEWAY | UINT32 | RW ¹ | 2 | RAM | GATEWAY address (set by XPORT) |
| 4300 | 0x10CC | Host Control | UINT16 | RW | 24 | RAM | Host control registers |
| 4300 | 0x10CC | | UINT16 | RW | 2 | RAM | reserved |
| 4302 | 0x10CE | Disables | FLAGS | RW | 1 | RAM | Host disables |
| 4303 | 0x10CF | CommandMode | UINT16 | RW | 1 | RAM | Host direct command mode |
| 4304 | 0x10D0 | Position | POS32 | RW | 2 | RAM | Host target position |
| 4306 | 0x10D2 | Velocity | VEL32 | RW | 2 | RAM | Host velocity command / velocity limit |
| 4308 | 0x10D4 | Acceleration | UACC32 | RW | 2 | RAM | Host acceleration limit |
| 4310 | 0x10D6 | Current | CUR16 | RW | 1 | RAM | Host current command / current limit |
| 4311 | 0x10D7 | Voltage | VOLT16 | RW | 1 | RAM | Host voltage command |
| 4312 | 0x10D8 | InputInhibits | FLAGS | RW | 1 | RAM | Host hardware input inhibits |
| 4313 | 0x10D9 | OutputInhibits | FLAGS | RW | 1 | RAM | Host hardware output inhibits |
| 4314 | 0x10DA | Outputs | FLAGS | RW | 1 | RAM | Host direct outputs |
| 4315 | 0x10DB | FactoryTest | UINT16 | RW | 1 | RAM | Reserved for factory and internal testing |
| 4316 | 0x10DC | IEG_MODE | UINT16 | RW | 1 | RAM | Host Input Event Groups |
| 4317 | 0x10DD | IEG_MOTION | UINT16 | RW | 1 | RAM | |
| 4318 | 0x10DE | IEG_MOVE_LEVEL | UINT16 | RW | 1 | RAM | |
| 4319 | 0x10DF | IEG_MOVE_EDGE | UINT16 | RW | 1 | RAM | |
| 4320 | 0x10E0 | IEG_MOVE_TEACH | UINT16 | RW | 1 | RAM | |
| 4321 | 0x10E1 | IEG_MOVE_SELECT | UINT16 | RW | 1 | RAM | |
| 4322 | 0x10E2 | IEG_MOVE_SWITCH | UINT16 | RW | 1 | RAM | |
| 4323 | 0x10E3 | | UINT16 | RW | 1 | RAM | reserved |

¹ These registers are initialized from their corresponding user parameters at start-up. Writing these registers will cause the new value to be copied to the corresponding user parameter and ALL user parameters will be re-saved to non-volatile memory.

² These registers are normally written by the Ethernet/IP MODBUS master.

User Parameters Registers Table

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|-----------------------|--------|-----------------|------|---------|--|
| 5000 | 0x1388 | Identification | UINT16 | RW | 16 | UP | |
| 5000 | 0x1388 | DriveName | STR16 | RW ¹ | 16 | UP | User drive name |
| 5100 | 0x13EC | System Configuration | UINT16 | RW | 45 | UP | Configuration option flags |
| 5100 | 0x13EC | Options | FLAGS | RW | 1 | UP | Configuration option flags |
| 5101 | 0x13ED | PowerUpDelay | UINT16 | RW | 1 | UP | Power-up delay [0.01 sec] |
| 5102 | 0x13EE | FaultDisables | FAULT | RW | 1 | UP | Output variable identifier to monitor on channel |
| 5103 | 0x13EF | FaultWarnings | FAULT | RW | 1 | UP | DAC low calibration offset |
| 5104 | 0x13F0 | FaultStop | FAULT | RW | 1 | UP | DAC high calibration offset |
| 5105 | 0x13F1 | FaultDedicatedMove | FAULT | RW | 1 | UP | Minimum variable value |
| 5106 | 0x13F2 | DefaultCommandMode | OPMODE | RW | 1 | UP | Main command mode selector |
| 5107 | 0x13F3 | AltCommandMode | OPMODE | RW | 1 | UP | Alternate command mode selector |
| 5108 | 0x13F4 | Ipeak | UCUR16 | RW | 1 | UP | User peak current command limit |
| 5109 | 0x13F5 | | UINT16 | RW | 1 | UP | reserved |
| 5110 | 0x13F6 | StopAccel | UACC32 | RW | 2 | UP | Stop acceleration [12.20 RPS/S] |
| 5112 | 0x13F8 | InPositionWindow | UINT32 | RW | 2 | UP | In position window width [16.16 REVS] |
| 5114 | 0x13FA | MaxFollowingError | POS32 | RW | 2 | UP | Following error limit [16.16 REVS] |
| 5116 | 0x13FC | InPositionTime | UINT16 | RW | 1 | UP | Time to in position [ms] |
| 5117 | 0x13FD | MaxFollowingErrorTime | UINT16 | RW | 1 | UP | Time to following error fault [0.01 sec] |
| 5118 | 0x13FE | PLimitMinus | POS32 | RW | 2 | UP | S/W position limit (-) [16.16 REVS] |
| 5120 | 0x1400 | PLimitPlus | POS32 | RW | 2 | UP | S/W position limit (+) [16.16 REVS] |
| 5122 | 0x1402 | PLimitPercentMinus | UINT16 | RW | 1 | UP | S/W position limit percent (-) [1.15 %] |
| 5123 | 0x1403 | PLimitPercentPlus | UINT16 | RW | 1 | UP | S/W position limit percent (+) [1.15 %] |
| 5124 | 0x1404 | PLimitVelocity | VEL32 | RW | 2 | UP | Position limit velocity limit |
| 5126 | 0x1406 | PLimitfoldback | UCUR16 | RW | 1 | UP | Position limit fold-back current limit |
| 5127 | 0x1407 | PLimitIpeak | UCUR16 | RW | 1 | UP | Position limit peak (seating) current |
| 5128 | 0x1408 | PLimitIpeakTime | UINT16 | RW | 1 | UP | Position limit seating time [ms] |
| 5129 | 0x1409 | InCurrentLimitTime | UINT16 | RW | 1 | UP | In current limit hysteresis time [0.1 sec] |
| 5130 | 0x140A | FaultLogFaults | FAULT | RW | 1 | UP | Fault log enables |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|---------------------------|--------|-----------------|------|-----------------|---|
| 5131 | 0x140B | | UINT16 | RW | 1 | UP | reserved |
| 5132 | 0x140C | FaultResetDelay | UINT16 | RW | 1 | UP | Fault auto-reset delay [0.01 sec] |
| 5133 | 0x140D | FaultLogDelay | UINT16 | RW | 1 | UP | Delay before logging faults [0.01 sec] |
| 5134 | 0x140E | Comms_power_upt_time | UINT16 | RW | 1 | UP | Comms fault power-up delay |
| 5135 | 0x140F | | UINT16 | RW | 1 | UP | Reserved |
| 5136 | 0x1410 | Comms_fault_timeout_a | UINT16 | RW | 1 | UP | Comms fault ch a cmd timeout |
| 5137 | 0x1411 | Comms_fault_timeout_b | UINT16 | RW | 1 | UP | Comms fault ch b cmd timeout |
| 5138 | 0x1412 | Fault_log_faults2 | UINT16 | RW | 1 | UP | Second group of 16 fault enables |
| 5139 | 0x1413 | Fault_disables2 | UINT16 | RW | 1 | UP | Secong group of 16 fault drive disable flags |
| 5140 | 0x1414 | Fault_warnings2 | UINT16 | RW | 1 | UP | Second group of 16 fault drive warning flags |
| 5141 | 0x1415 | Fault_stop2 | UINT16 | RW | 1 | UP | Second group of 16 fault drive stop flags |
| 5142 | 0x1416 | Fault_dedicated_move2 | UINT16 | RW | 1 | UP | Second group of 16 fault dedicated move flags |
| 5143 | 0x1417 | Low_VoltageDC_Warn_On | INT16 | RW | 1 | UP | Voltage at which Low voltage warning goes on |
| 5144 | 0x1418 | Low_VoltageDC_Warn_Off | INT16 | RW | 1 | UP | Voltage at which Low voltage warning goes off |
| 5150 | 0x141E | Ethernet | UINT16 | RW | 10 | UP | |
| 5150 | 0x141E | IP | UINT32 | RW ¹ | 2 | UP | IP (Internet Protocol) address |
| 5152 | 0x1420 | Subnet | UINT32 | RW ¹ | 2 | UP | Subnet address |
| 5154 | 0x1422 | Gateway | UINT32 | RW ¹ | 2 | UP | Gateway address |
| 5156 | 0x1424 | | UINT16 | RW | 4 | UP | reserved |
| 5300 | 0x14B4 | Modbus | UINT16 | RW | 6 | UP | |
| 5300 | 0x14B4 | Flags | FLAGS | RW ¹ | 1 | UP | Serial Channel A options |
| 5301 | 0x14B5 | AxisId | UINT16 | RW ¹ | 1 | UP ¹ | Serial Channel A axis identifier |
| 5302 | 0x14B6 | Baud | BAUD | RW ¹ | 1 | UP | Serial Channel A baud identifier |
| 5303 | 0x14B7 | CmdDelay | UINT16 | RW | 1 | UP | Serial Channel A extra RX delay |
| 5304 | 0x14B8 | FrameDelay | UINT16 | RW | 1 | UP | Serial Channel A extra TX delay |
| 5305 | 0x14B9 | | UINT16 | RW | 1 | UP | reserved |
| 5400 | 0x1518 | Tuning | UINT16 | RW | 6 | UP | |
| 5400 | 0x1518 | KJ | UINT16 | RW ¹ | 1 | UP | Inertia gain |
| 5401 | 0x1519 | | UINT16 | RW | 1 | UP | reserved |
| 5402 | 0x151A | KP | UINT16 | RW ¹ | 1 | UP | Position loop bandwidth |
| 5403 | 0x151B | KI | UINT16 | RW ¹ | 1 | UP | Velocity integral time constant |
| 5404 | 0x151C | KFF | UINT16 | RW ¹ | 1 | UP | Feed forward velocity scale |
| 5405 | 0x151D | KD | UINT16 | RW ¹ | 1 | UP | Velocity damping |
| 6000 | 0x1770 | Home | UINT16 | RW | 10 | UP | |
| 6000 | 0x1770 | Home.StartupOptions | FLAGS | RW | 1 | UP | Home option flags |
| 6001 | 0x1771 | | UINT16 | RW | 1 | UP | reserved |
| 6002 | 0x1772 | Home.Position1 | POS32 | RW | 2 | UP | Home reference position #1 |
| 6004 | 0x1774 | Home.Position2 | POS32 | RW | 2 | UP | Home reference position #2 |
| 6006 | 0x1776 | | UINT16 | RW | 4 | UP | reserved |
| 6020 | 0x1784 | Jog | UINT16 | RW | 8 | UP | |
| 6020 | 0x1784 | Jog.Options | FLAGS | RW | 1 | UP | Jog option flags |
| 6021 | 0x1785 | | UINT16 | RW | 1 | UP | reserved |
| 6022 | 0x1786 | Jog.SlowVelocity | UVEL32 | RW | 2 | UP | Jog slow velocity |
| 6024 | 0x1788 | Jog.FastVelocity | UVEL32 | RW | 2 | UP | Jog fast velocity |
| 6026 | 0x178A | Jog.Acceleration | UACC32 | RW | 2 | UP | Jog acceleration |
| 6100 | 0x17D4 | Move.0 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6100 | 0x17D4 | Move.0.Options | FLAGS | RW | 1 | UP | Options |
| 6101 | 0x17D5 | Move.0.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6102 | 0x17D6 | Move.0.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6104 | 0x17D8 | Move.0.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6105 | 0x17D9 | Move.0.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6106 | 0x17DA | Move.0.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6107 | 0x17DB | | UINT16 | RW | 1 | UP | reserved |
| 6108 | 0x17DC | Move.0.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6110 | 0x17DE | Move.0.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6112 | 0x17E0 | Move.0.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6113 | 0x17E1 | | UINT16 | RW | 1 | UP | reserved |
| 6114 | 0x17E2 | Move.0.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6116 | 0x17E4 | Move.0.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6118 | 0x17E6 | Move.1 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6118 | 0x17E6 | Move.1.Options | FLAGS | RW | 1 | UP | Options |
| 6119 | 0x17E7 | Move.1.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6120 | 0x17E8 | Move.1.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6122 | 0x17EA | Move.1.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6123 | 0x17EB | Move.1.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6124 | 0x17EC | Move.1.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6125 | 0x17ED | | UINT16 | RW | 1 | UP | reserved |
| 6126 | 0x17EE | Move.1.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6128 | 0x17F0 | Move.1.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6130 | 0x17F2 | Move.1.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|---------------------------|--------|--------|------|---------|-----------------------------|
| 6131 | 0x17F3 | | UINT16 | RW | 1 | UP | reserved |
| 6132 | 0x17F4 | Move.1.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6134 | 0x17F6 | Move.1.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6136 | 0x17F8 | Move.2 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6136 | 0x17F8 | Move.2.Options | FLAGS | RW | 1 | UP | Options |
| 6137 | 0x17F9 | Move.2.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6138 | 0x17FA | Move.2.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6140 | 0x17FC | Move.2.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6141 | 0x17FD | Move.2.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6142 | 0x17FE | Move.2.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6143 | 0x17FF | | UINT16 | RW | 1 | UP | reserved |
| 6144 | 0x1800 | Move.2.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6146 | 0x1802 | Move.2.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6148 | 0x1804 | Move.2.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6149 | 0x1805 | | UINT16 | RW | 1 | UP | reserved |
| 6150 | 0x1806 | Move.2.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6152 | 0x1808 | Move.2.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6154 | 0x180A | Move.3 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6154 | 0x180A | Move.3.Options | FLAGS | RW | 1 | UP | Options |
| 6155 | 0x180B | Move.3.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6156 | 0x180C | Move.3.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6158 | 0x180E | Move.3.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6159 | 0x180F | Move.3.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6160 | 0x1810 | Move.3.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6161 | 0x1811 | | UINT16 | RW | 1 | UP | reserved |
| 6162 | 0x1812 | Move.3.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6164 | 0x1814 | Move.3.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6166 | 0x1816 | Move.3.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6167 | 0x1817 | | UINT16 | RW | 1 | UP | reserved |
| 6168 | 0x1818 | Move.3.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6170 | 0x181A | Move.3.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6172 | 0x181C | Move.4 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6172 | 0x181C | Move.4.Options | FLAGS | RW | 1 | UP | Options |
| 6173 | 0x181D | Move.4.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6174 | 0x181E | Move.4.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6176 | 0x1820 | Move.4.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6177 | 0x1821 | Move.4.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6178 | 0x1822 | Move.4.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6179 | 0x1823 | | UINT16 | RW | 1 | UP | reserved |
| 6180 | 0x1824 | Move.4.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6182 | 0x1826 | Move.4.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6184 | 0x1828 | Move.4.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6185 | 0x1829 | | UINT16 | RW | 1 | UP | reserved |
| 6186 | 0x182A | Move.4.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6188 | 0x182C | Move.4.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6190 | 0x182E | Move.5 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6190 | 0x182E | Move.5.Options | FLAGS | RW | 1 | UP | Options |
| 6191 | 0x182F | Move.5.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6192 | 0x1830 | Move.5.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6194 | 0x1832 | Move.5.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6195 | 0x1833 | Move.5.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6196 | 0x1834 | Move.5.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6197 | 0x1835 | | UINT16 | RW | 1 | UP | reserved |
| 6198 | 0x1836 | Move.5.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6200 | 0x1838 | Move.5.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6202 | 0x183A | Move.5.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6203 | 0x183B | | UINT16 | RW | 1 | UP | reserved |
| 6204 | 0x183C | Move.5.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6206 | 0x183E | Move.5.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6208 | 0x1840 | Move.6 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6208 | 0x1840 | Move.6.Options | FLAGS | RW | 1 | UP | Options |
| 6209 | 0x1841 | Move.6.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6210 | 0x1842 | Move.6.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6212 | 0x1844 | Move.6.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6213 | 0x1845 | Move.6.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6214 | 0x1846 | Move.6.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6215 | 0x1847 | | UINT16 | RW | 1 | UP | reserved |
| 6216 | 0x1848 | Move.6.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6218 | 0x184A | Move.6.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6220 | 0x184C | Move.6.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|----------------------------|--------|--------|------|---------|-----------------------------|
| 6221 | 0x184D | | UINT16 | RW | 1 | UP | reserved |
| 6222 | 0x184E | Move.6.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6224 | 0x1850 | Move.6.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6226 | 0x1852 | Move.7 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6226 | 0x1852 | Move.7.Options | FLAGS | RW | 1 | UP | Options |
| 6227 | 0x1853 | Move.7.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6228 | 0x1854 | Move.7.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6230 | 0x1856 | Move.7.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6231 | 0x1857 | Move.7.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6232 | 0x1858 | Move.7.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6233 | 0x1859 | | UINT16 | RW | 1 | UP | reserved |
| 6234 | 0x185A | Move.7.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6236 | 0x185C | Move.7.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6238 | 0x185E | Move.7.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6239 | 0x185F | | UINT16 | RW | 1 | UP | reserved |
| 6240 | 0x1860 | Move.7.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6242 | 0x1862 | Move.7.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6244 | 0x1864 | Move.8 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6244 | 0x1864 | Move.8.Options | FLAGS | RW | 1 | UP | Options |
| 6245 | 0x1865 | Move.8.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6246 | 0x1866 | Move.8.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6248 | 0x1868 | Move.8.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6249 | 0x1869 | Move.8.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6250 | 0x186A | Move.8.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6251 | 0x186B | | UINT16 | RW | 1 | UP | reserved |
| 6252 | 0x186C | Move.8.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6254 | 0x186E | Move.8.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6256 | 0x1870 | Move.8.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6257 | 0x1871 | | UINT16 | RW | 1 | UP | reserved |
| 6258 | 0x1872 | Move.8.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6260 | 0x1874 | Move.8.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6262 | 0x1876 | Move.9 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6262 | 0x1876 | Move.9.Options | FLAGS | RW | 1 | UP | Options |
| 6263 | 0x1877 | Move.9.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6264 | 0x1878 | Move.9.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6266 | 0x187A | Move.9.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6267 | 0x187B | Move.9.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6268 | 0x187C | Move.9.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6269 | 0x187D | | UINT16 | RW | 1 | UP | reserved |
| 6270 | 0x187E | Move.9.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6272 | 0x1880 | Move.9.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6274 | 0x1882 | Move.9.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6275 | 0x1883 | | UINT16 | RW | 1 | UP | reserved |
| 6276 | 0x1884 | Move.9.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6278 | 0x1886 | Move.9.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6280 | 0x1888 | Move.10 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6280 | 0x1888 | Move.10.Options | FLAGS | RW | 1 | UP | Options |
| 6281 | 0x1889 | Move.10.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6282 | 0x188A | Move.10.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6284 | 0x188C | Move.10.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6285 | 0x188D | Move.10.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6286 | 0x188E | Move.10.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6287 | 0x188F | | UINT16 | RW | 1 | UP | reserved |
| 6288 | 0x1890 | Move.10.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6290 | 0x1892 | Move.10.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6292 | 0x1894 | Move.10.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6293 | 0x1895 | | UINT16 | RW | 1 | UP | reserved |
| 6294 | 0x1896 | Move.10.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6296 | 0x1898 | Move.10.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6298 | 0x189A | Move.11 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6298 | 0x189A | Move.11.Options | FLAGS | RW | 1 | UP | Options |
| 6299 | 0x189B | Move.11.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6300 | 0x189C | Move.11.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6302 | 0x189E | Move.11.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6303 | 0x189F | Move.11.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6304 | 0x18A0 | Move.11.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6305 | 0x18A1 | | UINT16 | RW | 1 | UP | reserved |
| 6306 | 0x18A2 | Move.11.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6308 | 0x18A4 | Move.11.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6310 | 0x18A6 | Move.11.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|----------------------------|--------|--------|------|---------|-----------------------------|
| 6311 | 0x18A7 | | UINT16 | RW | 1 | UP | reserved |
| 6312 | 0x18A8 | Move.11.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6314 | 0x18AA | Move.11.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6316 | 0x18AC | Move.12 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6316 | 0x18AC | Move.12.Options | FLAGS | RW | 1 | UP | Options |
| 6317 | 0x18AD | Move.12.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6318 | 0x18AE | Move.12.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6320 | 0x18B0 | Move.12.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6321 | 0x18B1 | Move.12.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6322 | 0x18B2 | Move.12.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6323 | 0x18B3 | | UINT16 | RW | 1 | UP | reserved |
| 6324 | 0x18B4 | Move.12.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6326 | 0x18B6 | Move.12.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6328 | 0x18B8 | Move.12.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6329 | 0x18B9 | | UINT16 | RW | 1 | UP | reserved |
| 6330 | 0x18BA | Move.12.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6332 | 0x18BC | Move.12.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6334 | 0x18BE | Move.13 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6334 | 0x18BE | Move.13.Options | FLAGS | RW | 1 | UP | Options |
| 6335 | 0x18BF | Move.13.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6336 | 0x18C0 | Move.13.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6338 | 0x18C2 | Move.13.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6339 | 0x18C3 | Move.13.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6340 | 0x18C4 | Move.13.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6341 | 0x18C5 | | UINT16 | RW | 1 | UP | reserved |
| 6342 | 0x18C6 | Move.13.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6344 | 0x18C8 | Move.13.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6346 | 0x18CA | Move.13.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6347 | 0x18CB | | UINT16 | RW | 1 | UP | reserved |
| 6348 | 0x18CC | Move.13.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6350 | 0x18CE | Move.13.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6352 | 0x18D0 | Move.14 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6352 | 0x18D0 | Move.14.Options | FLAGS | RW | 1 | UP | Options |
| 6353 | 0x18D1 | Move.14.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6354 | 0x18D2 | Move.14.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6356 | 0x18D4 | Move.14.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6357 | 0x18D5 | Move.14.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6358 | 0x18D6 | Move.14.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6359 | 0x18D7 | | UINT16 | RW | 1 | UP | reserved |
| 6360 | 0x18D8 | Move.14.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6362 | 0x18DA | Move.14.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6364 | 0x18DC | Move.14.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6365 | 0x18DD | | UINT16 | RW | 1 | UP | reserved |
| 6366 | 0x18DE | Move.14.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6368 | 0x18E0 | Move.14.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6370 | 0x18E2 | Move.15 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6370 | 0x18E2 | Move.15.Options | FLAGS | RW | 1 | UP | Options |
| 6371 | 0x18E3 | Move.15.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6372 | 0x18E4 | Move.15.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6374 | 0x18E6 | Move.15.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6375 | 0x18E7 | Move.15.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6376 | 0x18E8 | Move.15.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6377 | 0x18E9 | | UINT16 | RW | 1 | UP | reserved |
| 6378 | 0x18EA | Move.15.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6380 | 0x18EC | Move.15.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6382 | 0x18EE | Move.15.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6383 | 0x18EF | | UINT16 | RW | 1 | UP | reserved |
| 6384 | 0x18F0 | Move.15.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6386 | 0x18F2 | Move.15.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6388 | 0x18F4 | Emove | MOVE | RW | 18 | UP | Move 0 parameters |
| 6388 | 0x18F4 | .Emove.Options | FLAGS | RW | 1 | UP | Options |
| 6389 | 0x18F5 | Emove.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6390 | 0x18F6 | Emove.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6392 | 0x18F8 | Emove.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6393 | 0x18F9 | Emove.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6394 | 0x18FA | Emove.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6395 | 0x18FB | | UINT16 | RW | 1 | UP | reserved |
| 6396 | 0x18FC | Emove.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6398 | 0x18FE | Emove.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6400 | 0x1900 | Emove.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|----------------------------|---------|--------|------|---------|--------------------------------|
| 6401 | 0x1901 | | UINT16 | RW | 1 | UP | reserved |
| 6402 | 0x1902 | Emove.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6404 | 0x1904 | Emove.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6406 | 0x1906 | Home.0 | MOVE | RW | 18 | UP | Move 0 parameters |
| 6406 | 0x1906 | Home.0.Options | FLAGS | RW | 1 | UP | Options |
| 6407 | 0x1907 | Home.0.CurrentLimit | UCUR16 | RW | 1 | UP | Current limit |
| 6408 | 0x1908 | Home.0.Acceleration | UACC32 | RW | 2 | UP | Acceleration |
| 6410 | 0x190A | Home.0.TerminationSwitch | UINT16 | RW | 1 | UP | Termination switch |
| 6411 | 0x190B | Home.0.NextMove | UINT16 | RW | 1 | UP | Next move |
| 6412 | 0x190C | Home.0.Primary.Options | FLAGS | RW | 1 | UP | Primary motion options |
| 6413 | 0x190D | | UINT16 | RW | 1 | UP | reserved |
| 6414 | 0x190E | Home.0.Primary.Position | POS32 | RW | 2 | UP | Primary position/distance |
| 6416 | 0x1910 | Home.0.Primary.Velocity | UVEL32 | RW | 2 | UP | Primary velocity |
| 6418 | 0x1912 | Home.0.Secondary.Options | FLAGS | RW | 1 | UP | Secondary motion options |
| 6419 | 0x1913 | | UINT16 | RW | 1 | UP | reserved |
| 6420 | 0x1914 | Home.0.Secondary.Position | POS32 | RW | 2 | UP | Secondary position/distance |
| 6422 | 0x1916 | Home.0.Secondary.Velocity | UVEL32 | RW | 2 | UP | Secondary velocity |
| 6500 | 0x1964 | Deceleration | UACC32 | RW | 36 | UP | Decel rate for each move. |
| 6500 | 0x1964 | Decel0 | UINT32 | RW | 2 | UP | Decel move 0 |
| 6502 | 0x1966 | Decel1 | UINT32 | RW | 2 | UP | Decel move 1 |
| 6504 | 0x1968 | Decel2 | UINT32 | RW | 2 | Up | Decel move 2 |
| 6506 | 0x196A | Decel3 | UINT32 | RW | 2 | Up | Decel move3 |
| 6508 | 0x196C | Decel4 | UINT32 | RW | 2 | Up | Decel move4 |
| 6510 | 0x196E | Decel5 | UINT32 | RW | 2 | Up | Decel move5 |
| 6512 | 0x1970 | Decel6 | UINT32 | RW | 2 | Up | Decel move6 |
| 6514 | 0x1972 | Decel7 | UINT32 | RW | 2 | Up | Decel move7 |
| 6516 | 0x1974 | Decel8 | UINT32 | RW | 2 | Up | Decel move8 |
| 6518 | 0x1976 | Decel9 | UINT32 | RW | 2 | Up | Decel move9 |
| 6520 | 0x1978 | Decel10 | UINT32 | RW | 2 | Up | Decal move10 |
| 6522 | 0x197A | Decel11 | UINT32 | RW | 2 | Up | Decel move11 |
| 6524 | 0x197C | Decel12 | UINT32 | RW | 2 | Up | Decel move12 |
| 6526 | 0x197E | Decel13 | UINT32 | RW | 2 | Up | Decel move13 |
| 6528 | 0x1980 | Decel14 | UINT32 | RW | 2 | Up | Decel move14 |
| 6530 | 0x1982 | Decel15 | UINT32 | RW | 2 | Up | Decel move15 |
| 6532 | 0x1984 | Emove_Decel | UINT32 | RW | 2 | Up | Decel emove |
| 6534 | 0x1986 | Home_Decel | UINT32 | RW | 2 | Up | Decel home |
| 7000 | 0x1B58 | Digital I/O Polarities | UINT16 | RW | 2 | UP | Polarity bitmaps |
| 7000 | 0x1B58 | InputPolarities | FLAGS | RW | 1 | UP | Reverse input polarity bitmap |
| 7001 | 0x1B59 | OutputPolarities | FLAGS | RW | 1 | UP | Reverse output polarity bitmap |
| 7002 | 0x1B5A | Digital Input Assignments | UINT16 | RW | 16 | UP | |
| 7002 | 0x1B5A | Input.1.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7003 | 0x1B5B | Input1.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7004 | 0x1B5C | Input.2.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7005 | 0x1B5D | Input.2.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7006 | 0x1B5E | Input.3.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7007 | 0x1B5F | Input.3.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7008 | 0x1B60 | Input.4.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7009 | 0x1B61 | Input.4.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7010 | 0x1B62 | Input.5.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7011 | 0x1B63 | Input.5.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7012 | 0x1B64 | Input.6.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7013 | 0x1B65 | Input.6.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7014 | 0x1B66 | Input.7.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7015 | 0x1B67 | Input.7.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7016 | 0x1B68 | Input.8.GroupMap | IEG_XXX | RW | 1 | UP | Input 1 group map |
| 7017 | 0x1B69 | Input.8.Group | IGROUP | RW | 1 | UP | Input 1 event group |
| 7018 | 0x1B6A | Digital Output Assignments | UINT16 | RW | 32 | UP | |
| 7018 | 0x1B6A | Output.1.GroupMap | OEG_XXX | RW | 1 | UP | Output 1 group map |
| 7019 | 0x1B6B | Output.1.Group | OGROUP | RW | 1 | UP | Output 1 group |
| 7020 | 0x1B6C | Output.2.GroupMap | OEG_XXX | RW | 1 | UP | Output 2 group map |
| 7021 | 0x1B6D | Output.2.Group | OGROUP | RW | 1 | UP | Output 2 group |
| 7022 | 0x1B6E | Output.3.GroupMap | OEG_XXX | RW | 1 | UP | Output 3 group map |
| 7023 | 0x1B6F | Output.3.Group | OGROUP | RW | 1 | UP | Output 3 group |
| 7024 | 0x1B70 | Output.4.GroupMap | OEG_XXX | RW | 1 | UP | Output 4 group map |
| 7026 | 0x1B71 | Output.4.Group | OGROUP | RW | 1 | UP | Output 4 group |
| 7026 | 0x1B72 | | UINT16 | RW | 8 | UP | reserved |
| 7034 | 0x1B7A | RedLed.GroupMap | OEG_XXX | RW | 1 | UP | Red LED group map |
| 7035 | 0x1B7B | RedLed.Group | OGROUP | RW | 1 | UP | Red LED group |
| 7036 | 0x1B7C | GrnLed.GroupMap | OEG_XXX | RW | 1 | UP | GRN LED group map |
| 7037 | 0x1B7D | GrnLed.Group | OGROUP | RW | 1 | UP | GRN LED group |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|-----------------------------|---------|--------|------|---------|---|
| 7038 | 0x1B7E | | UINT16 | RW | 2 | UP | reserved |
| 7040 | 0x1B80 | Yel1Led.GroupMap | OEG_XXX | RW | 1 | UP | YEL1 LED group map |
| 7041 | 0x1B81 | Yel1Led.Group | OGROUP | RW | 1 | UP | YEL1 LED group |
| 7042 | 0x1B82 | Yel2Led.GroupMap | OEG_XXX | RW | 1 | UP | YEL2 LED group map |
| 7043 | 0x1B83 | Yel2Led.Group | OGROUP | RW | 1 | UP | YEL2 LED group |
| 7044 | 0x1B84 | | UINT16 | RW | 6 | UP | reserved |
| 7100 | 0x1BBC | Analog Position | UINT16 | RW | 10 | UP | |
| 7100 | 0x1BBC | | UINT16 | RW | 1 | UP | reserved |
| 7101 | 0x1BBD | Channel | UINT16 | RW | 1 | UP | Analog input channel |
| 7102 | 0x1BBE | Minimum | POS32 | RW | 2 | UP | Position min |
| 7104 | 0x1BC0 | Maximum | POS32 | RW | 2 | UP | Position max |
| 7106 | 0x1BC2 | Velocity | UVEL32 | RW | 2 | UP | Velocity limit |
| 7108 | 0x1BC4 | Acceleration | UACC32 | RW | 2 | UP | Acceleration limit |
| 7116 | 0x1BCC | Analog Velocity | UINT16 | RW | 8 | UP | |
| 7116 | 0x1BCC | | UINT16 | RW | 1 | UP | reserved |
| 7117 | 0x1BCD | Channel | UINT16 | RW | 1 | UP | Analog input channel |
| 7118 | 0x1BCE | Minimum | VEL32 | RW | 2 | UP | Velocity min |
| 7120 | 0x1BD0 | Maximum | VEL32 | RW | 2 | UP | Velocity max |
| 7122 | 0x1BD2 | Acceleration | UACC32 | RW | 2 | UP | Acceleration limit |
| 7132 | 0x1BDC | Analog Current | UINT16 | RW | 4 | UP | |
| 7132 | 0x1BDC | | UINT16 | RW | 1 | UP | reserved |
| 7133 | 0x1BDD | Channel | UINT16 | RW | 1 | UP | Analog input channel |
| 7134 | 0x1BDE | Minimum | CUR16 | RW | 1 | UP | Current min |
| 7135 | 0x1BDF | Maximum | CUR16 | RW | 1 | UP | Current max |
| 7184 | 0x1C0C | Velocity Override Alternate | UINT16 | RW | 4 | UP | |
| 7184 | 0x1C0C | Alternate | UINT16 | RW | 1 | UP | Holds Modbus alternative for Velocity Override. |
| 7184 | 0x1C10 | Velocity Override | UINT16 | RW | 4 | UP | |
| 7184 | 0x1C10 | | UINT16 | RW | 1 | UP | reserved |
| 7185 | 0x1C11 | Channel | UINT16 | RW | 1 | UP | Analog input channel |
| 7186 | 0x1C12 | Minimum | CUR16 | RW | 1 | UP | Current min |
| 7187 | 0x1C13 | Maximum | CUR16 | RW | 1 | UP | Current max |
| 7188 | 0x1C14 | Analog Alternates | UINT16 | RW | 4 | UP | |
| 7188 | 0x1C14 | Alt_position | UINT16 | RW | 1 | UP | Holds Modbus alternative for analog position. |
| 7189 | 0x1C15 | Alt_velocity | UINT16 | RW | 1 | UP | Holds Modbus alternative for analog velocity. |
| 7190 | 0x1C16 | Alt_torque | UINT16 | RW | 1 | UP | Holds Modbus alternative for analog torque. |
| 7191 | 0x1C17 | reserved | UINT16 | RW | 1 | UP | Reserved. |
| 7200 | 0x1C20 | AnalogIn.1 | UINT16 | RW | 30 | UP | Analog Input 1 |
| 7200 | 0x1C20 | AnalogIn.1.Options | FLAGS | RW | 1 | UP | Options |
| 7201 | 0x1C21 | AnalogIn.1.Bandwidth | UINT16 | RW | 1 | UP | Filter bandwidth |
| 7202 | 0x1C22 | AnalogIn.1.Mode1UserLow | INT32 | RW | 2 | UP | Mode 1 user low calibration |
| 7204 | 0x1C24 | AnalogIn.1.Mode1UserHigh | INT32 | RW | 2 | UP | Mode 1 user high calibration |
| 7206 | 0x1C26 | AnalogIn.1.Mode1AdcLow | INT32 | RW | 2 | UP | Mode 1 ADC low calibration |
| 7208 | 0x1C28 | AnalogIn.1.Mode1AdcHigh | INT32 | RW | 2 | UP | Mode 1 ADC high calibration |
| 7210 | 0x1C2A | AnalogIn.1.Mode2UserLow | INT32 | RW | 2 | UP | Mode 2 user low calibration |
| 7212 | 0x1C2C | AnalogIn.1.Mode2UserHigh | INT32 | RW | 2 | UP | Mode 2 user high calibration] |
| 7214 | 0x1C2E | AnalogIn.1.Mode2AdcLow | INT32 | RW | 2 | UP | Mode 2 ADC low calibration |
| 7216 | 0x1C30 | AnalogIn.1.Mode2AdcHigh | INT32 | RW | 2 | UP | Mode 2 ADC high calibration |
| 7218 | 0x1C32 | AnalogIn.1.RangeMinimum | INT32 | RW | 2 | UP | Minimum value of useable range |
| 7220 | 0x1C34 | AnalogIn.1.RangeMaximum | INT32 | RW | 2 | UP | Maximum value of useable range |
| 7222 | 0x1C36 | AnalogIn.1.FaultTripLow | INT32 | RW | 2 | UP | Fault trip low value |
| 7224 | 0x1C38 | AnalogIn.1.FaultTripHigh | INT32 | RW | 2 | UP | Fault trip high value |
| 7226 | 0x1C3A | | UINT16 | RW | 4 | UP | reserved |
| 7230 | 0x1C3E | AnalogIn.2 | UINT16 | RW | 30 | UP | Analog Input 2 |
| 7230 | 0x1C3E | AnalogIn.2.Options | FLAGS | RW | 1 | UP | Options |
| 7231 | 0x1C3F | AnalogIn.2.Bandwidth | UINT16 | RW | 1 | UP | Filter bandwidth |
| 7232 | 0x1C40 | AnalogIn.2.Mode1UserLow | INT32 | RW | 2 | UP | Mode 1 user low calibration |
| 7234 | 0x1C42 | AnalogIn.2.Mode1UserHigh | INT32 | RW | 2 | UP | Mode 1 user high calibration |
| 7236 | 0x1C44 | AnalogIn.2.Mode1AdcLow | INT32 | RW | 2 | UP | Mode 1 ADC low calibration |
| 7238 | 0x1C46 | AnalogIn.2.Mode1AdcHigh | INT32 | RW | 2 | UP | Mode 1 ADC high calibration |
| 7240 | 0x1C48 | AnalogIn.2.Mode2UserLow | INT32 | RW | 2 | UP | Mode 2 user low calibration |
| 7242 | 0x1C4A | AnalogIn.2.Mode2UserHigh | INT32 | RW | 2 | UP | Mode 2 user high calibration] |
| 7244 | 0x1C4C | AnalogIn.2.Mode2AdcLow | INT32 | RW | 2 | UP | Mode 2 ADC low calibration |
| 7246 | 0x1C4E | AnalogIn.2.Mode2AdcHigh | INT32 | RW | 2 | UP | Mode 2 ADC high calibration |
| 7248 | 0x1C50 | AnalogIn.2.RangeMinimum | INT32 | RW | 2 | UP | Minimum value of useable range |
| 7250 | 0x1C52 | AnalogIn.2.RangeMaximum | INT32 | RW | 2 | UP | Maximum value of useable range |
| 7252 | 0x1C54 | AnalogIn.2.FaultTripLow | INT32 | RW | 2 | UP | Fault trip low value |
| 7254 | 0x1C56 | AnalogIn.2.FaultTripHigh | INT32 | RW | 2 | UP | Fault trip high value |
| 7256 | 0x1C58 | | UINT16 | RW | 4 | UP | reserved |
| 7260 | 0x1C5C | AnalogIn.3 (reserved) | UINT16 | RW | 30 | UP | |
| 7290 | 0x1C7A | AnalogIn.4 (reserved) | UINT16 | RW | 30 | UP | |

| | | | | | | | |
|-------|----------|------------------------|--------|--------|------|---------|---------------------------------------|
| 7400 | 0x1CE8 | AnalogOut.1 | UINT16 | RW | 16 | UP | Analog Output 1 |
| 7400 | 0x1CE8 | AnalogOut.1.Options | FLAGS | RW | 1 | UP | Options |
| 7401 | 0x1CE9 | AnalogOut.1.Bandwidth | UINT16 | RW | 1 | UP | Filter bandwidth |
| 7402 | 0x1CEA | AnalogOut.1.Variable | UINT16 | RW | 1 | UP | Variable ID |
| 7403 | 0x1CEB | AnalogOut.1.Flags | UINT16 | RW | 1 | UP | Variable flags |
| 7404 | 0x1CEC | AnalogOut.1.CalLow | UINT16 | RW | 1 | UP | DAC low calibration offset |
| 7405 | 0x1CED | AnalogOut.1.CalHigh | UINT16 | RW | 1 | UP | DAC high calibration offset |
| 7406 | 0x1CEE | AnalogOut.1.VarMinimum | INT32 | RW | 2 | UP | Minimum variable value |
| 7408 | 0x1CF0 | AnalogOut.1.VarMaximum | INT32 | RW | 2 | UP | Maximum variable value |
| 7410 | 0x1CF2 | | UINT16 | RW | 6 | UP | reserved |
| 7416 | 0x1CF8 | AnalogOut.2 | UINT16 | RW | 16 | UP | Analog Output 2 |
| 7416 | 0x1CF8 | AnalogOut.2.Options | FLAGS | RW | 1 | UP | Options |
| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
| 7417 | 0x1CF9 | AnalogOut.2.Bandwidth | UINT16 | RW | 1 | UP | Filter bandwidth |
| 7418 | 0x1CFA | AnalogOut.2.Variable | UINT16 | RW | 1 | UP | Variable ID |
| 7419 | 0x1CFB | AnalogOut.2.Flags | UINT16 | RW | 1 | UP | Variable flags |
| 7420 | 0x1CFC | AnalogOut.2.CalLow | UINT16 | RW | 1 | UP | DAC low calibration offset |
| 7421 | 0x1CFD | AnalogOut.2.CalHigh | UINT16 | RW | 1 | UP | DAC high calibration offset |
| 7422 | 0x1CFE | AnalogOut.2.VarMinimum | INT32 | RW | 2 | UP | Minimum variable value |
| 7424 | 0x1D00 | AnalogOut.2.VarMaximum | INT32 | RW | 2 | UP | Maximum variable value |
| 7426 | 0x1D02 | | UINT16 | RW | 6 | UP | reserved |
| 7432 | 0x1D08 | AnalogOut.3 | UINT16 | RW | 16 | UP | Analog Output 3 |
| 7432 | 0x1D0A | AnalogOut.3.Options | FLAGS | RW | 1 | UP | Options |
| 7433 | 0x1D0C | AnalogOut.3.Bandwidth | UINT16 | RW | 1 | UP | Filter bandwidth |
| 7434 | 0x1D0E | AnalogOut.3.Variable | UINT16 | RW | 1 | UP | Variable ID |
| 7435 | 0x1D10 | AnalogOut.3.Flags | UINT16 | RW | 1 | UP | Variable flags |
| 7436 | 0x1D12 | AnalogOut.3.CalLow | UINT16 | RW | 1 | UP | DAC low calibration offset |
| 7437 | 0x1D14 | AnalogOut.3.CalHigh | UINT16 | RW | 1 | UP | DAC high calibration offset |
| 7438 | 0x1D16 | AnalogOut.3.VarMinimum | INT32 | RW | 2 | UP | Minimum variable value |
| 7440 | 0x1D18 | AnalogOut.3.VarMaximum | INT32 | RW | 2 | UP | Maximum variable value |
| 7442 | 0x1D1A | | UINT16 | RW | 6 | UP | reserved |
| 8000 | 0x1F40 | MappedRead | UINT16 | RW | 100 | UP | Mapped MODBUS ID Table 1 |
| 8200 | 0x2008 | MappedWrite | UINT16 | RW | 100 | UP | Mapped MODBUS ID Table 2 |
| 12500 | 0x30D4 | New_faults_Fault Log | UINT16 | RO | 1 | FL | Fault Log for new 16 faults |
| 12500 | 0x30D4 | CRC | UINT16 | RO | 1 | FL | Internal CRC check word |
| 12501 | 0x30D5 | | UINT16 | RO | 1 | FL | reserved |
| 12502 | 0x30D6 | FaultCount.16 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.16 |
| 12503 | 0x30D7 | FaultCount.17 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.17 |
| 12504 | 0x30D8 | FaultCount.18 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.18 |
| 12505 | 0x30D9 | FaultCount.19 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.19 |
| 12506 | 0x30DA | FaultCount.20 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.20 |
| 12507 | 0x30DB | FaultCount.21 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.21 |
| 12508 | 0x30DC | FaultCount.22 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.22 |
| 12509 | 0x30DD | FaultCount.23 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.23 |
| 12510 | 0x30DE | FaultCount.24 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.24 |
| 12511 | 0x30DF | FaultCount.25 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.25 |
| 12512 | 0x30E0 | FaultCount.26 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.26 |
| 12513 | 0x30E1 | FaultCount.27 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.27 |
| 12514 | 0x30E2 | FaultCount.28 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.28 |
| 12515 | 0x30E3 | FaultCount.29 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.29 |
| 12516 | 0x30E4 | FaultCount.30 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.30 |
| 12517 | 0x30E5 | FaultCount.31 | UINT16 | RO | 1 | FL | Count of faults observed for FAULT.31 |
| 12518 | 0x30E6 | PowerUpCount.16 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.16 fault |
| 12519 | 0x30E7 | PowerUpCount.17 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.17 fault |
| 12520 | 0x30E8 | PowerUpCount.18 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.18 fault |
| 12521 | 0x30E9 | PowerUpCount.19 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.19 fault |
| 12522 | 0x30EA | PowerUpCount.20 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.20 fault |
| 12523 | 0x30EB | PowerUpCount.21 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.21 fault |
| 12524 | 0x30EC | PowerUpCount.22 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.22 fault |
| 12525 | 0x30ED | PowerUpCount.23 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.23 fault |
| 12526 | 0x30EE | PowerUpCount.24 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.24 fault |
| 12527 | 0x30EF | PowerUpCount.25 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.25 fault |
| 12528 | 0x30F0 | PowerUpCount.26 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.26 fault |
| 12529 | 0x30F1 | PowerUpCount.27 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.27 fault |
| 12530 | 0x30F2 | PowerUpCount.28 | UINT16 | RO | 1 | FL | Power-up count of last FAULT.28 fault |
| 12531 | 0x30F3 | PowerUpCount.29 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.29 fault |
| 12532 | 0x30F4 | PowerUpCount.30 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.30 fault |
| 12533 | 0x30F5 | PowerUpCount.31 | UINT16 | RO | 1 | FL | Power-up count at last FAULT.31 fault |
| 12534 | 0x30F6 | PwmTime.16 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.16 fault |
| 12536 | 0x30F8 | PwmTime.17 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.17 fault |

| | | | | | | | |
|-------|----------|------------|--------|--------|------|---------|-------------------------------------|
| 12538 | 0x30FA | PwmTime.18 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.18 fault |
| 12540 | 0x30FC | PwmTime.19 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.19 fault |
| 12542 | 0x30FE | PwmTime.20 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.20 fault |
| 12544 | 0x3100 | PwmTime.21 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.21 fault |
| 12546 | 0x3102 | PwmTime.22 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.22 fault |
| 12548 | 0x3104 | PwmTime.23 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.23 fault |
| 12550 | 0x3106 | PwmTime.24 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.24 fault |
| 12552 | 0x3108 | PwmTime.25 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.25 fault |
| 12554 | 0x310A | PwmTime.26 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.26 fault |
| 12556 | 0x310C | PwmTime.27 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.27 fault |
| 12558 | 0x310E | PwmTime.28 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.28 fault |
| 12560 | 0x3110 | PwmTime.29 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.29 fault |
| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
| 12562 | 0x3112 | PwmTime.30 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.30 fault |
| 12564 | 0x3114 | PwmTime.31 | UINT32 | RO | 2 | FL | PWM run time at last FAULT.31 fault |

¹ These registers are considered *drive specific* and are not normally written by the Tritex user interface software during a user parameter download operation.

Mapped Table Values Registers

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|--------------------|--------|--------|------|---------|----------------------------------|
| 8400 | 0x20D0 | MappedReadValues | UINT16 | RW | 100 | NONE | Indirect read/write table values |
| 8400 | 0x20D0 | MappedReadValue.0 | UINT16 | RW | 1 | NONE | |
| 8401 | 0x20D1 | MappedReadValue.1 | UINT16 | RW | 1 | NONE | |
| 8402 | 0x20D2 | MappedReadValue.2 | UINT16 | RW | 1 | NONE | |
| 8403 | 0x20D3 | MappedReadValue.3 | UINT16 | RW | 1 | NONE | |
| 8404 | 0x20D4 | MappedReadValue.4 | UINT16 | RW | 1 | NONE | |
| 8405 | 0x20D5 | MappedReadValue.5 | UINT16 | RW | 1 | NONE | |
| 8406 | 0x20D6 | MappedReadValue.6 | UINT16 | RW | 1 | NONE | |
| 8407 | 0x20D7 | MappedReadValue.7 | UINT16 | RW | 1 | NONE | |
| 8408 | 0x20D8 | MappedReadValue.8 | UINT16 | RW | 1 | NONE | |
| 8409 | 0x20D9 | MappedReadValue.9 | UINT16 | RW | 1 | NONE | |
| 8410 | 0x20DA | MappedReadValue.10 | UINT16 | RW | 1 | NONE | |
| 8411 | 0x20DB | MappedReadValue.11 | UINT16 | RW | 1 | NONE | |
| 8412 | 0x20DC | MappedReadValue.12 | UINT16 | RW | 1 | NONE | |
| 8413 | 0x20DD | MappedReadValue.13 | UINT16 | RW | 1 | NONE | |
| 8414 | 0x20DE | MappedReadValue.14 | UINT16 | RW | 1 | NONE | |
| 8415 | 0x20DF | MappedReadValue.15 | UINT16 | RW | 1 | NONE | |
| 8416 | 0x20E0 | MappedReadValue.16 | UINT16 | RW | 1 | NONE | |
| 8417 | 0x20E1 | MappedReadValue.17 | UINT16 | RW | 1 | NONE | |
| 8418 | 0x20E2 | MappedReadValue.18 | UINT16 | RW | 1 | NONE | |
| 8419 | 0x20E3 | MappedReadValue.19 | UINT16 | RW | 1 | NONE | |
| 8420 | 0x20E4 | MappedReadValue.2 | UINT16 | RW | 1 | NONE | |
| 8421 | 0x20E5 | MappedReadValue.21 | UINT16 | RW | 1 | NONE | |
| 8422 | 0x20E6 | MappedReadValue.22 | UINT16 | RW | 1 | NONE | |
| 8423 | 0x20E7 | MappedReadValue.23 | UINT16 | RW | 1 | NONE | |
| 8424 | 0x20E8 | MappedReadValue.24 | UINT16 | RW | 1 | NONE | |
| 8425 | 0x20E9 | MappedReadValue.25 | UINT16 | RW | 1 | NONE | |
| 8426 | 0x20EA | MappedReadValue.26 | UINT16 | RW | 1 | NONE | |
| 8427 | 0x20EB | MappedReadValue.27 | UINT16 | RW | 1 | NONE | |
| 8428 | 0x20EC | MappedReadValue.28 | UINT16 | RW | 1 | NONE | |
| 8429 | 0x20ED | MappedReadValue.29 | UINT16 | RW | 1 | NONE | |
| 8430 | 0x20EE | MappedReadValue.30 | UINT16 | RW | 1 | NONE | |
| 8431 | 0x20EF | MappedReadValue.31 | UINT16 | RW | 1 | NONE | |
| 8432 | 0x20F0 | MappedReadValue.32 | UINT16 | RW | 1 | NONE | |
| 8433 | 0x20F1 | MappedReadValue.33 | UINT16 | RW | 1 | NONE | |
| 8434 | 0x20F2 | MappedReadValue.34 | UINT16 | RW | 1 | NONE | |
| 8435 | 0x20F3 | MappedReadValue.35 | UINT16 | RW | 1 | NONE | |
| 8436 | 0x20F4 | MappedReadValue.36 | UINT16 | RW | 1 | NONE | |
| 8437 | 0x20F5 | MappedReadValue.37 | UINT16 | RW | 1 | NONE | |
| 8438 | 0x20F6 | MappedReadValue.38 | UINT16 | RW | 1 | NONE | |
| 8439 | 0x20F7 | MappedReadValue.39 | UINT16 | RW | 1 | NONE | |
| 8440 | 0x20F8 | MappedReadValue.40 | UINT16 | RW | 1 | NONE | |
| 8441 | 0x20F9 | MappedReadValue.41 | UINT16 | RW | 1 | NONE | |
| 8442 | 0x20FA | MappedReadValue.42 | UINT16 | RW | 1 | NONE | |
| 8443 | 0x20FB | MappedReadValue.43 | UINT16 | RW | 1 | NONE | |
| 8444 | 0x20FC | MappedReadValue.44 | UINT16 | RW | 1 | NONE | |
| 8445 | 0x20FD | MappedReadValue.45 | UINT16 | RW | 1 | NONE | |
| 8446 | 0x20FE | MappedReadValue.46 | UINT16 | RW | 1 | NONE | |
| 8447 | 0x20FF | MappedReadValue.47 | UINT16 | RW | 1 | NONE | |
| 8448 | 0x2100 | MappedReadValue.48 | UINT16 | RW | 1 | NONE | |
| 8449 | 0x2101 | MappedReadValue.49 | UINT16 | RW | 1 | NONE | |
| 8450 | 0x2102 | MappedReadValue.50 | UINT16 | RW | 1 | NONE | |
| 8451 | 0x2103 | MappedReadValue.51 | UINT16 | RW | 1 | NONE | |
| 8452 | 0x2104 | MappedReadValue.52 | UINT16 | RW | 1 | NONE | |
| 8453 | 0x2105 | MappedReadValue.53 | UINT16 | RW | 1 | NONE | |
| 8454 | 0x2106 | MappedReadValue.54 | UINT16 | RW | 1 | NONE | |
| 8455 | 0x2107 | MappedReadValue.55 | UINT16 | RW | 1 | NONE | |
| 8456 | 0x2108 | MappedReadValue.56 | UINT16 | RW | 1 | NONE | |
| 8457 | 0x2109 | MappedReadValue.57 | UINT16 | RW | 1 | NONE | |
| 8458 | 0x210A | MappedReadValue.58 | UINT16 | RW | 1 | NONE | |
| 8459 | 0x210B | MappedReadValue.59 | UINT16 | RW | 1 | NONE | |
| 8460 | 0x210C | MappedReadValue.60 | UINT16 | RW | 1 | NONE | |
| 8461 | 0x210D | MappedReadValue.61 | UINT16 | RW | 1 | NONE | |
| 8462 | 0x210E | MappedReadValue.62 | UINT16 | RW | 1 | NONE | |
| 8463 | 0x210F | MappedReadValue.63 | UINT16 | RW | 1 | NONE | |
| 8464 | 0x2110 | MappedReadValue.64 | UINT16 | RW | 1 | NONE | |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|---------------------|--------|--------|------|---------|----------------------------------|
| 8465 | 0x2111 | MappedReadValue.65 | UINT16 | RW | 1 | NONE | |
| 8466 | 0x2112 | MappedReadValue.66 | UINT16 | RW | 1 | NONE | |
| 8467 | 0x2113 | MappedReadValue.67 | UINT16 | RW | 1 | NONE | |
| 8468 | 0x2114 | MappedReadValue.68 | UINT16 | RW | 1 | NONE | |
| 8469 | 0x2115 | MappedReadValue.69 | UINT16 | RW | 1 | NONE | |
| 8470 | 0x2116 | MappedReadValue.70 | UINT16 | RW | 1 | NONE | |
| 8471 | 0x2117 | MappedReadValue.71 | UINT16 | RW | 1 | NONE | |
| 8472 | 0x2118 | MappedReadValue.72 | UINT16 | RW | 1 | NONE | |
| 8473 | 0x2119 | MappedReadValue.73 | UINT16 | RW | 1 | NONE | |
| 8474 | 0x211A | MappedReadValue.74 | UINT16 | RW | 1 | NONE | |
| 8475 | 0x211B | MappedReadValue.75 | UINT16 | RW | 1 | NONE | |
| 8476 | 0x211C | MappedReadValue.76 | UINT16 | RW | 1 | NONE | |
| 8477 | 0x211D | MappedReadValue.77 | UINT16 | RW | 1 | NONE | |
| 8478 | 0x211E | MappedReadValue.78 | UINT16 | RW | 1 | NONE | |
| 8479 | 0x211F | MappedReadValue.79 | UINT16 | RW | 1 | NONE | |
| 8480 | 0x2120 | MappedReadValue.80 | UINT16 | RW | 1 | NONE | |
| 8481 | 0x2121 | MappedReadValue.81 | UINT16 | RW | 1 | NONE | |
| 8482 | 0x2122 | MappedReadValue.82 | UINT16 | RW | 1 | NONE | |
| 8483 | 0x2123 | MappedReadValue.83 | UINT16 | RW | 1 | NONE | |
| 8484 | 0x2124 | MappedReadValue.84 | UINT16 | RW | 1 | NONE | |
| 8485 | 0x2125 | MappedReadValue.85 | UINT16 | RW | 1 | NONE | |
| 8486 | 0x2126 | MappedReadValue.86 | UINT16 | RW | 1 | NONE | |
| 8487 | 0x2127 | MappedReadValue.87 | UINT16 | RW | 1 | NONE | |
| 8488 | 0x2128 | MappedReadValue.88 | UINT16 | RW | 1 | NONE | |
| 8489 | 0x2129 | MappedReadValue.89 | UINT16 | RW | 1 | NONE | |
| 8490 | 0x212A | MappedReadValue.90 | UINT16 | RW | 1 | NONE | |
| 8491 | 0x212B | MappedReadValue.91 | UINT16 | RW | 1 | NONE | |
| 8492 | 0x212C | MappedReadValue.92 | UINT16 | RW | 1 | NONE | |
| 8493 | 0x212D | MappedReadValue.93 | UINT16 | RW | 1 | NONE | |
| 8494 | 0x212E | MappedReadValue.94 | UINT16 | RW | 1 | NONE | |
| 8495 | 0x212F | MappedReadValue.95 | UINT16 | RW | 1 | NONE | |
| 8496 | 0x2130 | MappedReadValue.96 | UINT16 | RW | 1 | NONE | |
| 8497 | 0x2131 | MappedReadValue.97 | UINT16 | RW | 1 | NONE | |
| 8498 | 0x2132 | MappedReadValue.98 | UINT16 | RW | 1 | NONE | |
| 8499 | 0x2133 | MappedReadValue.99 | UINT16 | RW | 1 | NONE | |
| 8600 | 0x2198 | MappedWriteValues | UINT16 | RW | 100 | NONE | Indirect read/write table values |
| 8600 | 0x2198 | MappedWriteValue.0 | UINT16 | RW | 1 | NONE | |
| 8601 | 0x2199 | MappedWriteValue.1 | UINT16 | RW | 1 | NONE | |
| 8602 | 0x219A | MappedWriteValue.2 | UINT16 | RW | 1 | NONE | |
| 8603 | 0x219B | MappedWriteValue.3 | UINT16 | RW | 1 | NONE | |
| 8604 | 0x219C | MappedWriteValue.4 | UINT16 | RW | 1 | NONE | |
| 8605 | 0x219D | MappedWriteValue.5 | UINT16 | RW | 1 | NONE | |
| 8606 | 0x219E | MappedWriteValue.6 | UINT16 | RW | 1 | NONE | |
| 8607 | 0x219F | MappedWriteValue.7 | UINT16 | RW | 1 | NONE | |
| 8608 | 0x21A0 | MappedWriteValue.8 | UINT16 | RW | 1 | NONE | |
| 8609 | 0x21A1 | MappedWriteValue.9 | UINT16 | RW | 1 | NONE | |
| 8610 | 0x21A2 | MappedWriteValue.10 | UINT16 | RW | 1 | NONE | |
| 8611 | 0x21A3 | MappedWriteValue.11 | UINT16 | RW | 1 | NONE | |
| 8612 | 0x21A4 | MappedWriteValue.12 | UINT16 | RW | 1 | NONE | |
| 8613 | 0x21A5 | MappedWriteValue.13 | UINT16 | RW | 1 | NONE | |
| 8614 | 0x21A6 | MappedWriteValue.14 | UINT16 | RW | 1 | NONE | |
| 8615 | 0x21A7 | MappedWriteValue.15 | UINT16 | RW | 1 | NONE | |
| 8616 | 0x21A8 | MappedWriteValue.16 | UINT16 | RW | 1 | NONE | |
| 8617 | 0x21A9 | MappedWriteValue.17 | UINT16 | RW | 1 | NONE | |
| 8618 | 0x21AA | MappedWriteValue.18 | UINT16 | RW | 1 | NONE | |
| 8619 | 0x21AB | MappedWriteValue.19 | UINT16 | RW | 1 | NONE | |
| 8620 | 0x21AC | MappedWriteValue.20 | UINT16 | RW | 1 | NONE | |
| 8621 | 0x21AD | MappedWriteValue.21 | UINT16 | RW | 1 | NONE | |
| 8622 | 0x21AE | MappedWriteValue.22 | UINT16 | RW | 1 | NONE | |
| 8623 | 0x21AF | MappedWriteValue.23 | UINT16 | RW | 1 | NONE | |
| 8624 | 0x21B0 | MappedWriteValue.24 | UINT16 | RW | 1 | NONE | |
| 8625 | 0x21B1 | MappedWriteValue.25 | UINT16 | RW | 1 | NONE | |
| 8626 | 0x21B2 | MappedWriteValue.26 | UINT16 | RW | 1 | NONE | |
| 8627 | 0x21B3 | MappedWriteValue.27 | UINT16 | RW | 1 | NONE | |
| 8628 | 0x21B4 | MappedWriteValue.28 | UINT16 | RW | 1 | NONE | |
| 8629 | 0x21B5 | MappedWriteValue.29 | UINT16 | RW | 1 | NONE | |
| 8630 | 0x21B6 | MappedWriteValue.30 | UINT16 | RW | 1 | NONE | |
| 8631 | 0x21B7 | MappedWriteValue.31 | UINT16 | RW | 1 | NONE | |
| 8632 | 0x21B8 | MappedWriteValue.32 | UINT16 | RW | 1 | NONE | |
| 8633 | 0x21B9 | MappedWriteValue.33 | UINT16 | RW | 1 | NONE | |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|---------------------|--------|--------|------|---------|-------------|
| 8634 | 0x21BA | MappedWriteValue.34 | UINT16 | RW | 1 | NONE | |
| 8635 | 0x21BB | MappedWriteValue.35 | UINT16 | RW | 1 | NONE | |
| 8636 | 0x21BC | MappedWriteValue.36 | UINT16 | RW | 1 | NONE | |
| 8637 | 0x21BD | MappedWriteValue.37 | UINT16 | RW | 1 | NONE | |
| 8638 | 0x21BE | MappedWriteValue.38 | UINT16 | RW | 1 | NONE | |
| 8639 | 0x21BF | MappedWriteValue.39 | UINT16 | RW | 1 | NONE | |
| 8640 | 0x21C0 | MappedWriteValue.40 | UINT16 | RW | 1 | NONE | |
| 8641 | 0x21C1 | MappedWriteValue.41 | UINT16 | RW | 1 | NONE | |
| 8642 | 0x21C2 | MappedWriteValue.42 | UINT16 | RW | 1 | NONE | |
| 8643 | 0x21C3 | MappedWriteValue.43 | UINT16 | RW | 1 | NONE | |
| 8644 | 0x21C4 | MappedWriteValue.44 | UINT16 | RW | 1 | NONE | |
| 8645 | 0x21C5 | MappedWriteValue.45 | UINT16 | RW | 1 | NONE | |
| 8646 | 0x21C6 | MappedWriteValue.46 | UINT16 | RW | 1 | NONE | |
| 8647 | 0x21C7 | MappedWriteValue.47 | UINT16 | RW | 1 | NONE | |
| 8648 | 0x21C8 | MappedWriteValue.48 | UINT16 | RW | 1 | NONE | |
| 8649 | 0x21C9 | MappedWriteValue.49 | UINT16 | RW | 1 | NONE | |
| 8650 | 0x21CA | MappedWriteValue.50 | UINT16 | RW | 1 | NONE | |
| 8651 | 0x21CB | MappedWriteValue.51 | UINT16 | RW | 1 | NONE | |
| 8652 | 0x21CC | MappedWriteValue.52 | UINT16 | RW | 1 | NONE | |
| 8653 | 0x21CD | MappedWriteValue.53 | UINT16 | RW | 1 | NONE | |
| 8654 | 0x21CE | MappedWriteValue.54 | UINT16 | RW | 1 | NONE | |
| 8655 | 0x21CF | MappedWriteValue.55 | UINT16 | RW | 1 | NONE | |
| 8656 | 0x21D0 | MappedWriteValue.56 | UINT16 | RW | 1 | NONE | |
| 8657 | 0x21D1 | MappedWriteValue.57 | UINT16 | RW | 1 | NONE | |
| 8658 | 0x21D2 | MappedWriteValue.58 | UINT16 | RW | 1 | NONE | |
| 8659 | 0x21D3 | MappedWriteValue.59 | UINT16 | RW | 1 | NONE | |
| 8660 | 0x21D4 | MappedWriteValue.60 | UINT16 | RW | 1 | NONE | |
| 8661 | 0x21D5 | MappedWriteValue.61 | UINT16 | RW | 1 | NONE | |
| 8662 | 0x21D6 | MappedWriteValue.62 | UINT16 | RW | 1 | NONE | |
| 8663 | 0x21D7 | MappedWriteValue.63 | UINT16 | RW | 1 | NONE | |
| 8664 | 0x21D8 | MappedWriteValue.64 | UINT16 | RW | 1 | NONE | |
| 8665 | 0x21D9 | MappedWriteValue.65 | UINT16 | RW | 1 | NONE | |
| 8666 | 0x21DA | MappedWriteValue.66 | UINT16 | RW | 1 | NONE | |
| 8667 | 0x21DB | MappedWriteValue.67 | UINT16 | RW | 1 | NONE | |
| 8668 | 0x21DC | MappedWriteValue.68 | UINT16 | RW | 1 | NONE | |
| 8669 | 0x21DD | MappedWriteValue.69 | UINT16 | RW | 1 | NONE | |
| 8670 | 0x21DE | MappedWriteValue.70 | UINT16 | RW | 1 | NONE | |
| 8671 | 0x21DF | MappedWriteValue.71 | UINT16 | RW | 1 | NONE | |
| 8672 | 0x21E0 | MappedWriteValue.72 | UINT16 | RW | 1 | NONE | |
| 8673 | 0x21E1 | MappedWriteValue.73 | UINT16 | RW | 1 | NONE | |
| 8674 | 0x21E2 | MappedWriteValue.74 | UINT16 | RW | 1 | NONE | |
| 8675 | 0x21E3 | MappedWriteValue.75 | UINT16 | RW | 1 | NONE | |
| 8676 | 0x21E4 | MappedWriteValue.76 | UINT16 | RW | 1 | NONE | |
| 8677 | 0x21E5 | MappedWriteValue.77 | UINT16 | RW | 1 | NONE | |
| 8678 | 0x21E6 | MappedWriteValue.78 | UINT16 | RW | 1 | NONE | |
| 8679 | 0x21E7 | MappedWriteValue.79 | UINT16 | RW | 1 | NONE | |
| 8680 | 0x21E8 | MappedWriteValue.80 | UINT16 | RW | 1 | NONE | |
| 8681 | 0x21E9 | MappedWriteValue.81 | UINT16 | RW | 1 | NONE | |
| 8682 | 0x21EA | MappedWriteValue.82 | UINT16 | RW | 1 | NONE | |
| 8683 | 0x21EB | MappedWriteValue.83 | UINT16 | RW | 1 | NONE | |
| 8684 | 0x21EC | MappedWriteValue.84 | UINT16 | RW | 1 | NONE | |
| 8685 | 0x21ED | MappedWriteValue.85 | UINT16 | RW | 1 | NONE | |
| 8686 | 0x21EE | MappedWriteValue.86 | UINT16 | RW | 1 | NONE | |
| 8687 | 0x21EF | MappedWriteValue.87 | UINT16 | RW | 1 | NONE | |
| 8688 | 0x21F0 | MappedWriteValue.88 | UINT16 | RW | 1 | NONE | |
| 8689 | 0x21F1 | MappedWriteValue.89 | UINT16 | RW | 1 | NONE | |
| 8690 | 0x21F2 | MappedWriteValue.90 | UINT16 | RW | 1 | NONE | |
| 8691 | 0x21F3 | MappedWriteValue.91 | UINT16 | RW | 1 | NONE | |
| 8692 | 0x21F4 | MappedWriteValue.92 | UINT16 | RW | 1 | NONE | |
| 8693 | 0x21F5 | MappedWriteValue.93 | UINT16 | RW | 1 | NONE | |
| 8694 | 0x21F6 | MappedWriteValue.94 | UINT16 | RW | 1 | NONE | |
| 8695 | 0x21F7 | MappedWriteValue.95 | UINT16 | RW | 1 | NONE | |
| 8696 | 0x21F8 | MappedWriteValue.96 | UINT16 | RW | 1 | NONE | |
| 8697 | 0x21F9 | MappedWriteValue.97 | UINT16 | RW | 1 | NONE | |
| 8698 | 0x21FA | MappedWriteValue.98 | UINT16 | RW | 1 | NONE | |
| 8699 | 0x21FB | MappedWriteValue.99 | UINT16 | RW | 1 | NONE | |

Factory Parameters Register Table

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|-----------------------|---------|--------|------|---------|--|
| 9000 | 0x2328 | Identification | UINT16 | RW | 32 | FP | Factory identification parameters |
| 9000 | 0x2328 | PartNumber | STR16 | RW | 16 | FP | Factory part number |
| 9016 | 0x2338 | SerialNumber | STR16 | RW | 16 | FP | Factory serial number |
| 9100 | 0x238C | Actuator | UINT16 | RW | 26 | FP | Actuator parameters |
| 9100 | 0x238C | Model | STR16 | RW | 16 | FP | Model name |
| 9116 | 0x239C | Options | FLAGS | RW | 1 | FP | Option flags |
| 9117 | 0x238D | EcyclesPerRev | UINT16 | RW | 1 | FP | Poles / 2 |
| 9118 | 0x238E | R | UINT16 | RW | 1 | FP | Resistance [8.8 ohms L-L] |
| 9119 | 0x238F | L | UINT16 | RW | 1 | FP | Inductance [8.8 mH L-L] |
| 9120 | 0x2390 | J | UINT32 | RW | 2 | FP | Inertia [0.32 KG-M^2] |
| 9122 | 0x2392 | KT | UINT16 | RW | 1 | FP | KT [6.10 NM/AMP] |
| 9123 | 0x2393 | FeedbackDevice | UINT16 | RW | 1 | FP | Position feedback device type |
| 9124 | 0x2394 | StepsPerRev | UINT32 | RW | 2 | FP | Encoder steps/rev |
| 9200 | 0x23F0 | Limits | UINT16 | RW | 14 | FP | Factory limits parameters |
| 9200 | 0x23F0 | LowVoltageTripLevel | UVOLT16 | RW | 1 | FP | Low voltage fault trip level |
| 9201 | 0x23F1 | HighVoltageTripLevel | UVOLT16 | RW | 1 | FP | High voltage fault trip level |
| 9202 | 0x23F2 | BoardTempTripLevel | INT16 | RW | 1 | FP | PCB board temperature trip level |
| 9203 | 0x23F3 | Itrip | UCUR16 | RW | 1 | FP | Current fault trip level |
| 9204 | 0x23F4 | Ipeak | UCUR16 | RW | 1 | FP | Peak command current |
| 9205 | 0x23F5 | Icontinuous | UCUR16 | RW | 1 | FP | Continuous current rating |
| 9206 | 0x23F6 | IcTimeConstant | INT16 | RW | 1 | FP | Continuous current time constant |
| 9207 | 0x23F7 | | UINT16 | RW | 1 | FP | reserved |
| 9208 | 0x23F8 | | UINT16 | RW | 1 | FP | reserved |
| 9209 | 0x23F9 | ActuatorTempTripLevel | INT16 | RW | 1 | FP | Actuator temperature fault trip level |
| 9210 | 0x23FA | PwmModulation | INT16 | RW | 1 | FP | PWM modulation factor |
| 9211 | 0x23FB | ShuntHigh | UINT16 | RW | 1 | FP | High shunt level (shunt ON) |
| 9212 | 0x23FC | ShuntLow | UINT16 | RW | 1 | FP | Low shunt level (shunt OFF) |
| 9213 | 0x23FD | | UINT16 | RW | 1 | FP | reserved |
| 9300 | 0X2454 | Initialization | UINT16 | RW | 30 | FP | Initialization / calibration parameters |
| 9300 | 0X2454 | Options | FLAGS | RW | 1 | FP | Option and option board flags |
| 9301 | 0X2455 | VbusScale | INT16 | RW | 1 | FP | DC Bus voltage scale |
| 9302 | 0X2456 | BoardTempOffset | INT16 | RW | 1 | FP | PCB board temperature offset |
| 9303 | 0X2457 | BoardTempScale | INT16 | RW | 1 | FP | PCB board temperature scale |
| 9304 | 0X2458 | PsinInZero | INT16 | RW | 1 | FP | Peak command current |
| 9305 | 0X2459 | PsinInScale | INT16 | RW | 1 | FP | Continuous current rating |
| 9306 | 0X245A | PcosinInZero | INT16 | RW | 1 | FP | Continuous current time constant |
| 9307 | 0X245B | PcosinInScale | INT16 | RW | 1 | FP | reserved |
| 9308 | 0X245C | RphaseOffset | INT16 | RW | 1 | FP | reserved |
| 9309 | 0X245D | RphaseScale | INT16 | RW | 1 | FP | Actuator temperature fault trip level |
| 9310 | 0X245E | SphaseOffset | INT16 | RW | 1 | FP | PWM modulation factor |
| 9311 | 0X245F | SphaseScale | INT16 | RW | 1 | FP | High shunt level (shunt ON) |
| 9312 | 0X2460 | | UINT16 | RW | 1 | FP | reserved |
| 9313 | 0X2461 | | UINT16 | RW | 1 | FP | reserved |
| 9314 | 0X2462 | | UINT16 | RW | 1 | FP | reserved |
| 9315 | 0X2463 | Eoffset | INT16 | RW | 1 | FP | Electrical angle offset |
| 9316 | 0X2464 | | UINT16 | RW | 1 | FP | reserved |
| 9317 | 0X2465 | | UINT16 | RW | 1 | FP | reserved |
| 9318 | 0X2466 | | UINT16 | RW | 1 | FP | reserved |
| 9319 | 0X2467 | | UINT16 | RW | 1 | FP | reserved |
| 9320 | 0X2468 | BrakeReleaseDelay | UINT16 | RW | 1 | FP | Brake release delay [0.01s] |
| 9321 | 0X2469 | BrakeEngageDelay | UINT16 | RW | 1 | FP | Brake engage delay [0.01s] |
| 9322 | 0X246A | | UINT16 | RW | 1 | FP | reserved |
| 9323 | 0X246B | TharmonicMag | INT16 | RW | 1 | FP | Torque harmonic magnitude [2.14 AMPS] |
| 9324 | 0X246C | | UINT16 | RW | 1 | FP | reserved |
| 9325 | 0X246D | | UINT16 | RW | 1 | FP | reserved |
| 9326 | 0X246E | | UINT16 | RW | 1 | FP | reserved |
| 9327 | 0X246F | | UINT16 | RW | 1 | FP | reserved |
| 9328 | 0X2470 | ActuatorTempOffset | INT16 | RW | 1 | FP | Actuator temperature offset [13.3 DEG] |
| 9329 | 0X2471 | ActuatorTempScale | INT16 | RW | 1 | FP | Actuator temp scale [13.3 DEG/ADFULLSCALE] |
| 9400 | 0X24B8 | Tuning | UINT16 | RW | 8 | FP | Tuning parameters |
| 9400 | 0X24B8 | Options | FLAGS | RW | 1 | FP | Option flags |
| 9401 | 0X24B9 | HallBW | UINT16 | RW | 1 | FP | Position angle tracking bandwidth |
| 9402 | 0X24BA | HallDamping | UINT16 | RW | 1 | FP | Position angle tracking damping |
| 9403 | 0X24BB | IloopBW | UINT16 | RW | 1 | FP | Current loop bandwidth [HZ] |
| 9404 | 0X24BC | | UINT16 | RW | 1 | FP | reserved |
| 9405 | 0X24BD | VbusBW | UINT16 | RW | 1 | FP | Bus voltage filter bandwidth [HZ] |

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|---------------------------|--------|--------|------|---------|--|
| 9406 | 0X24BE | | UINT16 | RW | 1 | FP | reserved |
| 9407 | 0X24BF | | UINT16 | RW | 1 | FP | reserved |
| 9500 | 0X251C | Position Correction Table | INT16 | RW | 64 | FP | Position correction factors table parameters |
| 9600 | 0X2580 | CommutationTable | UINT16 | RW | 8 | FP | UVW commutation table parameters |
| 9700 | 0X25E4 | Communications | UINT16 | RW | 6 | FP | Serial Channel B parameters |
| 9700 | 0X25E4 | Flags | FLAGS | RW | 1 | FP | Serial Channel B options |
| 9701 | 0X25E5 | AxisId | UINT16 | RW | 1 | FP | Serial Channel B axis identifier |
| 9702 | 0X25E6 | Baud | BAUD | RW | 1 | FP | Serial Channel B baud identifier |
| 9703 | 0X25E7 | CmdDelay | UINT16 | RW | 1 | FP | Serial Channel B extra RX delay |
| 9704 | 0X25E8 | FrameDelay | UINT16 | RW | 1 | FP | Serial Channel B extra TX delay |
| 9705 | 0X25E9 | | UINT16 | RW | 1 | FP | reserved |

Factory Identification Register Table

Registers in this table are read-only and are stored in ROM flash memory.

| ID | ID (hex) | Name | Type | Access | Size | Storage | Description |
|------|----------|----------------|--------|--------|------|---------|---|
| 9900 | 0x26AC | Checksums | UINT16 | RO | 8 | ROM | Flash code checksums [sectors A..H] |
| 9908 | 0x26B4 | Sectors | FLAGS | RO | 1 | ROM | Sectors requiring checksums |
| 9909 | 0x26B5 | Options | FLAGS | RO | 1 | ROM | Flags |
| 9910 | 0x26B6 | AppIdentifier | ENUM | RO | 1 | ROM | Application code identifier |
| 9911 | 0x26B7 | AppVersion | UINT16 | RO | 1 | ROM | Application firmware version [0.01 units] |
| 9912 | 0x26B8 | | UINT16 | RO | 2 | ROM | reserved |
| 9914 | 0x26BA | Startup | UINT32 | RO | 2 | ROM | Address of app startup code |
| 9916 | 0x26BC | BootIdentifier | ENUM | RO | 1 | ROM | Boot code identifier |
| 9917 | 0x26BD | BootVersion | UINT16 | RO | 1 | ROM | Boot code firmware version [0.01 units] |
| 9918 | 0x26BE | DspType | ENUM | RO | 1 | ROM | DSP identifier |
| 9919 | 0x26BF | | UINT16 | RO | 13 | ROM | reserved |