

Parameter Dictionary



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1. ABOUT THIS MANUAL

1.1 Overview and Scope

This manual provides cross-referenced definitions of the parameters used to program and operate Copley Controls drives.

1.2 Related Documentation

CANopen-related documents:

- *CANopen Programmer's Manual*
- *CML Reference Manual*
- *Copley Motion Objects Programmer's Guide*

DeviceNet-related:

- *Copley DeviceNet Programmer's Guide*

Also of related interest:

- *CME User Guide*
- *Copley Indexer 2 Program User Guide (describes use of Indexer 2 Program to create motion control sequences)*
- *Copley ASCII Interface Programmer's Guide (describes how to send ASCII format commands over an RS232 serial bus to control one or more drives)*
- *Copley Camming User Guide (describes the use of the Copley Controls Camming feature, and its setup through CME)*
- *Extending Plus Module I/O application note.*
- *Trigger Outputs at Position application note.*

All these publications, along with hardware manuals and data sheets, can be found on www.copleycontrols.com

1.3 Comments

Copley Controls welcomes your comments on this manual. See www.copleycontrols.com for contact information.

1.4 Copyrights

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Copley Controls.

Xenus, Accelnet, Stepnet, Accelus, and Junus are registered trademarks of Copley Controls.

CME is a registered trademark of Copley Controls.

MACRO is a registered trademark of Delta Tau Corp.

1.5 Document Validity

We reserve the right to modify our products. The information in this document is subject to change without notice and does not represent a commitment by Copley Controls. Copley Controls assumes no responsibility for any errors that may appear in this document.

1.6 Product Warnings

Observe all relevant state, regional, and local safety regulations when installing and using Copley Controls drives. For safety and to assure compliance with documented system data, only Copley Controls should perform repairs to drives.



DANGER

Hazardous voltages.

Exercise caution when installing and adjusting Copley drives.

Risk of electric shock.

On some Copley Controls drives, high-voltage circuits are connected to mains power. Refer to hardware documentation.

Risk of unexpected motion with non-latched faults.

After the cause of a non-latched fault is corrected, the drive re-enables the PWM output stage without operator intervention. In this case, motion may re-start unexpectedly. Configure faults as latched unless a specific situation calls for non-latched behavior. When using non-latched faults, be sure to safeguard against unexpected motion.

Latching an output does not eliminate the risk of unexpected motion with non-latched faults.

Associating a fault with a latched, custom-configured output does not latch the fault itself. After the cause of a non-latched fault is corrected, the drive re-enables without operator intervention. In this case, motion may re-start unexpectedly.

For more information, see [Fault Mask \(0xA7\)](#).

When operating the drive as a CAN or DeviceNet node, the use of CME or ASCII serial commands may affect operations in progress. Using such commands to initiate motion may cause network operations to suspend.

Operation may restart unexpectedly when the commanded motion is stopped.

Use equipment as described.

Operate drives within the specifications provided in the relevant hardware manual or data sheet.

FAILURE TO HEED THESE WARNINGS CAN CAUSE EQUIPMENT DAMAGE, INJURY, OR DEATH.

1.7 Revision History

Revision	Date	Comments
00	December 2013	Added new parameters and fixed existing content.
01	September 2014	Fixed units for parameter 0x5e
02	March 2019	Added new parameters and fixed the existing content

2 INTRODUCTION

2.1 Scope and Purpose of this Document

This document provides a listing and definitions of the parameters used to program and operate Copley Controls drives. These parameters can be accessed using any of several communication interfaces, each with its own protocol and set of IDs for the parameters.

There are many CANopen and EtherCAT objects for which there are no direct correlations to Copley drive parameters. Refer to the *CANopen Programmer's Manual* for a complete list of supported objects.

2.2 Organization of the Parameter Listings

The parameters are listed in tables consisting of the following columns:

The **ASCII** (American Standard Code for Information Exchange) column contains the parameter's Copley ASCII Interface parameter ID. This ID would also be used with Copley Controls Indexer 2 Program. The ID is listed in hex format.

The **CAN/ECAT IDX:SUB** column contains the CANopen and EtherCAT object index and sub-index of a parameter. The index is in hex format and the sub-index is in decimal format.

Note that the CANopen and EtherCAT object libraries are identical.

The **MACRO** column contains the parameter's MACRO I-variable ID. The MACRO I-variable ID of a parameter is offset from the ASCII Interface parameter ID by decimal 1024 (hex 0x400).

The **Mem** column indicates whether the parameter is stored in drive RAM (R), drive flash memory (F), or both (RF).

An asterisk next to R in this column indicates that the parameter is read-only. Parameters without an asterisk can be read and written.

The **Type** column indicates the parameter's data type. Types include:

- String: 20 words
- Integer (8, 16, 32, or 64-bit): INT8, INT16, INT32, INT64
- Unsigned (8, 16, 32, or 64-bit): U8, U16, U32, U64

Cross references for each parameter include, where applicable, the equivalent MACRO I-variable ID, and CANopen (and EtherCAT) object index and sub-index.

The **DvcNet** column has been removed from this revision of the parameter dictionary. DeviceNet ID can be derived from the ASCII ID by adding 1 to it.

Example: ASCII 0x00 = DvcNet 0x01 or ASCII 0x0F = DvcNet 0x10

2.3 Important Notes

CME Refresh Behavior

When parameters are changed using one of the interfaces described in this manual, the changes will not necessarily be recognized by an active CME session.

Input/Output Numbering

Inputs and Outputs on Copley drives are numbered starting from zero for all the communication interfaces listed in this document. If a drive has 12 inputs, they are numbered 0 through 11. CME software starts numbering at 1 (input 0 is called IN1 in CME software).

3 PARAMETERS

* Indicates read only parameters. All others are read and write parameters.

3.1 Parameters Sorted by ASCII Interface Parameter ID

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
0x00	0x400	0x2380:1	RF	U16	Current Loop Proportional Gain (Cp).
0x01	0x401	0x2380:2	RF	U16	Current Loop Integral Gain (Ci).
0x02	0x402	0x2340	RF	INT16	Current loop programmed value. Units: 0.01 A. This current will be used to command drive when Desired State (0x24) is set to 1.
0x03	0x403	0x2203	R*	INT16	Winding A Current. Units: 0.01 A. Actual current measured at winding A.
0x04	0x404	0x2204	R*	INT16	Winding B Current. Units: 0.01 A. Actual current measured at winding B.
0x05	0x405	0x2210	R*	INT16	Current Offset A. Units: 0.01 A. Offset value applied to winding A current reading. This offset is calculated by drive at startup.
0x06	0x406	0x2211	R*	INT16	Current Offset B. Units: 0.01 A. Offset value applied to winding B current reading. This offset is calculated by drive at startup.
0x07	0x407	0x2212	R*	INT16	X Axis of calculated stator current vector. Units: 0.01 A.
0x08	0x408	0x2213	R*	INT16	Y Axis of calculated stator current vector. Units: 0.01 A.
0x09	0x409	0x221A	R*	INT16	Stator Voltage, X axis. Units: 0.1 V
0x0A	0x40A	0x221B	R*	INT16	Stator Voltage, Y axis. Units: 0.1 V
0x0B	0x40B	0x2214	R*	INT16	Actual Current, D axis of rotor space. Units: 0.01 A.
0x0C	0x40C	0x2215	R*	INT16	Actual Current, Q axis of rotor space. Units: 0.01 A.
0x0D	0x40D	0x2216	R*	INT16	Commanded current, D axis of rotor space. Part of internal current loop calculation. Units: 0.01 A.
0x0E	0x40E	0x2217	R*	INT16	Commanded Current, Q axis of rotor space. Part of internal current loop calculation. Units: 0.01 A.
0x0F	0x40F	None	R*	INT16	Current Error, D axis of rotor space. Units: 0.01 A.
0x10	0x410	None	R*	INT16	Current Error, Q axis of rotor space. Units: 0.01 A.
0x11	0x411	None	R*	INT16	Current Integral Value, D axis of rotor space.
0x12	0x412	None	R*	INT16	Current Integral Value, Q axis of rotor space.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
0x13	0x413	0x2218	R*	INT16	Current Loop Output, D axis of rotor space. Units: 0.1 V
0x14	0x414	0x2219	R*	INT16	Current Loop Output, Q axis of rotor space. Units: 0.1 V
0x15	0x415	0x221D	R*	INT16	Commanded Motor Current. Units: 0.01 A. This is value presently being sent to current loop. It may come from programmed value, analog reference, velocity loop, etc. depending on drive's desired state.
0x17	0x417	0x6064	R	INT32	Actual Position. Units: Counts. Used to close position loop in drive every servo cycle. For single feedback systems, this value is same as Actual Motor Position (0x32) . For dual feedback systems, this value is same as Load Encoder Position (0x112) . CANopen objects 0x6064 and 0x6063 hold same value.
0x18	0x418	0x6069	R*	INT32	Actual Velocity. Units: 0.1 encoder counts/s. For estimated velocity. Units: 0.01 RPM. For stepper mode: Units: 0.1 microsteps/s.
0x19	0x419	0x2310	RF	INT32	Analog reference scaling factor. This value is used to scale analog reference input voltage to command that will be used to drive current, velocity or position loop (depending on drive state). When in current mode (Desired State (0x24) = 2), value programmed specifies commanded current when 10 V is applied to analog input. Units: 0.01 A. For example, to command 12 A at 10 V, scaling factor would be 1200. When in velocity mode (Desired State (0x24) = 12), value programmed specifies commanded velocity when 10 V is applied to analog input. Units: 0.1 encoder counts/s. For estimated velocity. Units: 0.01 RPM. For stepper mode. Units: 0.1 microsteps/s. When in position mode (Desired State (0x24) = (22 or 32), value programmed specifies commanded position (in encoder counts) when 10 V is applied to analog input.
0x1A	0x41A	0x2311	RF	INT16	Offset Value applied to Analog Input or Analog Reference Input. Units: mV.
0x1B	0x41B	0x2205	R*	INT16	Analog Encoder Sine Input Voltage. Units: 0.1 mV. Also known as Sine Feedback Voltage.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0x1C	0x41C	0x2206	R*	INT16	Analog Encoder Cosine Input Voltage. Units: 0.1 mV. Also known as Cosine Feedback Voltage.	
0x1D	0x41D	0x2200	R*	INT16	Analog Input. Units: mV. Also known as Analog Reference Input Voltage.	
0x1E	0x41E	0x2201	R*	INT16	High Voltage A/D Reading. Units: 100 mV. Bus Voltage present on internal high-voltage bus.	
0x20	0x420	0x2202	R*	INT16	Drive Temperature A/D Reading. Units: degrees C.	
0x21	0x421	0x2110	RF	INT16	Peak Current Limit. Units: 0.01 A. Used by I ² T algorithm to protect motor. Also known as Boost current on stepper drives. This value cannot exceed Drive Peak Current.	
0x22	0x422	0x2111	RF	INT16	Continuous Current Limit. Units: 0.01 A. Used by I ² T algorithm to protect motor. Also known as Run Current on stepper drives. This value should not exceed User Peak Current Limit.	
0x23	0x423	0x2112	RF	U16	Time at Peak Current Limit. Units: ms. Used by I ² T algorithm to protect motor. Also known as Time at Boost Current for stepper drives.	
0x24	0x424	0x2300	RF	U16	Desired State:	
					Value	Description
					0	Drive disabled.
					1	Programmed current value drives current loop
					2	Analog reference drives current loop
					3	PWM input drives current loop
					4	Function generator drives current loop
					5	UV current mode
					6	Reserved for future use
					7	Current command slaved to other axis
					8-10	Reserved for future use
					11	Programmed velocity value drives velocity loop
					12	Analog reference drives velocity loop
					13	PWM input drives velocity loop
					14	Function generator drives velocity loop
					15-16	Reserved for future use
					17	Velocity command saved to other axis
18-20	Reserved for future use					
21	Trajectory generator drives position loop					
22	Analog reference drives position loop					
23	Digital input lines drive position loop (Pulse & direction, master encoder, etc.)					
24	Function generator drives position loop					

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					25 Cam tables drive position loop
					26 Analog reference commands velocity to position loop
					27 Position command slaved to another axis
					28-29 Reserved for future use
					30 CANopen interface controls drive
					31 Trajectory generator drives microstepper
					32 Analog reference drives micostepper position
					33 Digital input lines drive microstepper
					34 Function generator drives microstepper
					35 Cam tables drive microstepper
					36 Analog reference drives microstepper velocity
					37-39 Reserved for future use
					40 CANopen interface controls microstepper
					41 Reserved for future use
					42 Simple micro-stepping mode. For diagnostic use only
0x25	0x425	0x221E	R*	INT16	Limited Motor Current Command. Units: 0.01 A.
0x26	0x426	0x2313	RF	INT16	Analog Reference Input Deadband. Units: mV. Deadband window value applied to analog command input.
0x27	0x427	0x2381:1	RF	U16	Velocity Loop Proportional Gain (Vp).
0x28	0x428	0x2381:2	RF	U16	Velocity Loop Integral Gain (Vi).
0x29	0x429	0x2230	R*	INT32	Velocity Loop Limited Velocity. This is commanded velocity after it passes through acceleration and velocity limits and velocity command filter. Velocity error used by loop is difference between actual velocity and this value. Units: 0.1 encoder counts/s. For estimated velocity. Units: 0.01 RPM. For stepper mode. Units: 0.1 microsteps/s.
0x2A	0x42A	None	R*	INT32	Velocity Loop Error.
0x2B	0x42B	None	R*	INT32	Velocity Loop Integral Sum.
0x2C	0x42C	0x606B	R*	INT32	Commanded Velocity. Units: 0.1 encoder counts/s. For estimated velocity. Units: 0.01 RPM. For stepper mode. Units: 0.1 microsteps/s.
0x2D	0x42D	0x6062	R*	INT32	Commanded Position. Units: counts. Also known as Limited Position in CME.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
0x2E	0x42E	0x2381:3	RF	U16	Velocity Loop Acceleration Feed Forward (Aff). Acceleration command from trajectory generator is multiplied by this value and result is added to velocity loop output.
0x2F	0x42F	0x2341	RF	IN0T32	Programmed Velocity Command. Only used in Programmed Velocity Mode (Desired State (0x24) = 11) Units: 0.1 encoder counts/s. For estimated velocity. Units: 0.01 RPM. For stepper mode. Units: 0.1 microsteps/s.
0x30	0x430	0x2382:1	RF	U16	Position Loop Proportional Gain (Pp).
0x31	0x431	0x2381:4	RF	INT16	Velocity Loop Shift Value. After velocity loop is calculated, result is right shifted this (value) many times to arrive at commanded current value. This allows velocity loop gains to have reasonable values for high resolution encoders.
0x32	0x432	0x2240	R*	INT32	Actual Motor Position. Units: counts. Gives feedback position of motor. For single feedback systems, this is same as Actual Position (0x17) .
0x33	0x433	0x2382:2	RF	U16	Position Loop Velocity Feed Forward (Vff). Vff value is multiplied by Instantaneous Commanded Velocity (0x3B) generated by trajectory generator. Product is added to output of position loop. This gain is scaled by 1/16384. Therefore, setting this gain to 0x4000 (16384) would cause input velocity to be multiplied by 1.0, and result added to output of position loop.
0x34	0x434	0x2382:3	RF	U16	Position Loop Acceleration Feed Forward (Aff). Aff value is multiplied by Instantaneous Commanded Velocity (0x3B) generated by trajectory generator. Product is added to output of position loop.
0x35	0x435	0x60F4	R*	INT32	Position Loop Error. Units: counts. Difference between Actual Position (0x17) and Commanded Position (0x2D) .
0x36	0x436	0x2100	RF	U32	Velocity Loop Acceleration Limit. Units: 1000 counts/s ² . Used by velocity loop limiter. Not used when velocity loop is controlled by position loop.
0x37	0x437	0x2101	RF	U32	Velocity Loop Deceleration Limit. Units: 1000 counts/s ² . Used by velocity loop limiter. Not used when velocity loop is controlled by position loop.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description		
0x38	0x438	0x221C	R*	INT16	Actual Motor Current. Units: 0.01 A. This current is calculated based on both D and Q axis currents.		
0x39	0x439	0x2102	RF	U32	Velocity Loop Emergency Stop Deceleration Rate. Units: 1000 counts/s ² .		
0x3A	0x43A	0x2103	RF	INT32	Velocity Loop Velocity Limit. Units 0.1 counts/s. This value is limit on commanded velocity used by velocity loop. Note that this limit is always in effect.		
0x3B	0x43B	0x2250	R*	INT32	Instantaneous Commanded Velocity. Units: 0.1 encoder counts/s. This velocity is output of trajectory generator and is value by which position loop's velocity feed forward is multiplied.		
0x3C	0x43C	0x2251	R*	U32	Instantaneous Commanded Acceleration. Units: 10 encoder counts/s ² . This acceleration is output of trajectory generator and is value by which position loop's acceleration feed forward is multiplied.		
0x3D	0x43D	0x2122	R*	INT32	Trajectory Destination Position. Units: encoder counts. This is position that trajectory generator is using as its destination.		
0x3E	0x43E	0x2104	RF	INT32	Velocity Window. Units: 0.1 counts/s. If absolute value of velocity loop error exceeds this, then velocity window bit in Event Status Register (0xA0) will be set.		
0x3F	0x43F	0x2105	RF	U16	Velocity Window Time. Units: ms. Velocity window bit in Event Status Register (0xA0) will be cleared when absolute velocity error is less than velocity window for this amount of time.		
0x40	0x440	0x2383:1	F	U16	Motor Type. Type of motor connected to drive. Bit-mapped as follows:		
					Bits	Description	
					0	Set for linear, clear for rotary.	
					1-3	Reserved.	
					4-5	Motor architecture:	
						0	Not specified.
						1	Brushed servo.
2	Microstepper.						
3	Brushless servo.						
6-15	Reserved.						
0x41	0x441	0x6404	F	String	Motor Manufacturer.		
0x42	0x442	0x6403	F	String	Motor Model.		

Parameter Dictionary

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description		
0x43	0x443	0x2383:27	F	INT16	Motor Units. This is only used by CME for display. (0=metric, 1=English).		
0x44	0x444	0x2383:9	F	INT32	Motor Inertia (Mass). Units: Rotary = 0.000001 Kg/cm ² Units: Linear = 0.0001 Kg.		
0x45	0x445	0x2383:2	F	INT16	Motor Poll Pairs (used only for rotary motors). Number of motor pole pairs (electrical phases) per rotation. For stepper motors, Poll Pairs = (360 deg / Motor deg/step) / 4.		
0x46	0x446	0x2383:16	F	U16	Motor Brake Type. 0=present, 1=none.		
0x47	0x447	0x2383:15	F	U16	Motor Temperature Sensor Type. 0=none, 1=present.		
0x48	0x448	0x2383:12	F	INT32	Motor Torque Constant. Units: 0.00001 Nm/A.		
0x49	0x449	0x2383:7	F	INT16	Motor Resistance. Units: 10 mΩ.		
0x4A	0x44A	0x2383:8	F	INT16	Motor Inductance. Units: 10 μH.		
0x4B	0x44B	0x2383:13	F	INT32	Motor Peak Torque. Units: 0.00001 Nm units.		
0x4C	0x44C	0x2383:14	F	INT32	Motor Continuous Torque. Units: 0.00001 Nm units.		
0x4D	0x44D	0x2383:11	F	INT32	Motor Max Velocity. Units: 0.1 encoder counts/s.		
0x4E	0x44E	0x2383:3	F	U16	Motor Wiring. 0=standard, 1= drive's U and V outputs are swapped.		
0x4F	0x44F	0x2383:6	RF	INT16	Motor Hall Offset. Units: degrees. Offset angle to be applied to Hall Effect sensors.		
0x50	0x450	0x2383:4	F	INT16	Motor Hall Type. Type of Hall Effect sensors attached to motor:		
					Value	Description	
					0	No Hall Effect sensors available.	
					1	Digital Hall Effect sensors.	
2	Analog Hall Effect sensors.						
0x51	0x451	0x2383:10	F	U32	Motor back EMF constant (obsolete , variable 0x56 is now used which accesses same data but with extended range) Units: rotary 0.01 V/krpm, linear 0.01 V/mps		
0x52	0x452	0x2383:5	F	INT16	Motor Hall Effect Wiring. Bit-mapped as follows: NOTE: When analog Halls are used, only bit 8 is relevant.		
					Bits	Description	
					0-2	The Hall wiring code (see below).	
						Value	Hall Ordering
						0	U V W
1	U W V						
2	V U W						

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description								
					<table border="1"> <tr> <td>3</td> <td>V W U</td> </tr> <tr> <td>4</td> <td>W V U</td> </tr> <tr> <td>5</td> <td>W U V</td> </tr> <tr> <td>6, 7</td> <td>Reserved</td> </tr> </table>	3	V W U	4	W V U	5	W U V	6, 7	Reserved
3	V W U												
4	W V U												
5	W U V												
6, 7	Reserved												
					3	Reserved.							
					4	Invert W Hall input if set. Inversion occurs after Halls wiring is changed by bits 0-2.							
					5	Invert V Hall input if set. Inversion occurs after Halls wiring is changed by bits 0-2.							
					6	Invert U Hall input if set. Inversion occurs after Halls wiring is changed by bits 0-2.							
					7	Reserved.							
					8	If set, reverse analog Halls.							
					9-15	Reserved.							
0x53	0x453	0x2383:17	F	U16	Motor Brake Activation Time. Units: ms.								
0x54	0x454	0x2383:18	F	U16	Motor Brake Delay Time. Units: ms. After brake output is activated, drive will stay enabled for this amount of time to allow brake to engage.								
0x55	0x455	0x2383:19	F	INT32	Motor Brake Activation Velocity. Units: 0.1 counts/s. Also known as Motor Brake Velocity (CANopen). During Motor Brake Activation Time (0x53) , if motor's actual velocity falls below this value brake output is activated immediately.								
0x56	0x456	0x2383:10	F	U32	Motor Back EMF Constant. Units: rotary 0.01 V/krpm. Units: linear 0.01 V/mps. Back EMF velocity estimation can be disabled by setting to zero.								
0x57	0x457	0x2383:29	F	U32	Microsteps/Motor Rev. Units: microsteps. This parameter is used in true microstepping mode.								
0x58	0x458	0x2383:33	F	INT32	Motor Gear Ratio. This parameter may be used to store gear ratio information for dual encoder systems where gearbox sits between two encoders. This parameter is not used by firmware and is supported as convenience to CME program. Gear ratio is ratio of two 16-bit values. First word gives number of motor turns and is numerator. Second word gives number of position turns and is denominator.								

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0x59	0x459	0x2107	RF	INT16	Hall Velocity Mode Shift Value. This parameter is only used in Hall velocity mode. It specifies left shift value for position and velocity information calculated in that mode.	
0x5A	0x45A	0x2241	RF	INT16	Encoder Output Configuration. This parameter determines source of buffered encoder output on drives which support it. Bit-mapped as follows:	
					Bits	Description
					0-1	Mode of operation for encoder output lines.
					0	Output buffered primary encoder (hardware buffering).
					1	Configure pins as secondary encoder input.
					2	Output simulated encoder outputs tracking motor encoder.
					3	Output simulated encoder outputs tracking load encoder.
					4	If set, force X and S channels to be inputs no matter what mode bits 0-1 specify. This is useful for some special modes that take commands on these lines while outputting encoder data on the A and B lines.
					8-11	For simulated encoder outputs, these bits configure scaling value that adjusts number of encoder output counts for each encoder count on the input.
					0	No adjustment, 1 count on the encoder is 1 output count.
					1	Multiply encoder counts by 2.
					2	Divide encoder counts by 2.
					3	Divide encoder counts by 4.
4	Divide encoder counts by 8.					
5	Divide encoder counts by 16.					
6	Divide encoder counts by 32.					
7	Divide encoder counts by 64.					
8	Divide encoder counts by 128.					
9	Divide encoder counts by 256.					

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description																												
					<table border="1"> <tr> <td>12-13</td> <td>For simulated encoder outputs, these bits allow the max output frequency to be reduced</td> </tr> <tr> <td>0</td> <td>No change to max output frequency</td> </tr> <tr> <td>1</td> <td>Divide max output frequency by 2</td> </tr> <tr> <td>2</td> <td>Divide max output frequency by 4</td> </tr> <tr> <td>3</td> <td>Divide max output frequency by 8</td> </tr> </table>	12-13	For simulated encoder outputs, these bits allow the max output frequency to be reduced	0	No change to max output frequency	1	Divide max output frequency by 2	2	Divide max output frequency by 4	3	Divide max output frequency by 8																		
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3	Divide max output frequency by 8																																
0x5B	0x45B	0x2383:32	F	INT32	Load Encoder Resolution. Units: Encoder unit/count. Used for linear motors only. Number of Motor Encoder Units (0x61) per encoder count.																												
0x5C	0x45C	0x2383:31	F	INT16	Load Encoder Direction. 0=normal, 1=reverse. Note: Change in direction will affect motor phasing.																												
0x5D	0x45D	0x2383:30	F	U16	<p>Load Encoder Type. This parameter identifies type of encoder used on load when running in dual loop mode. Encoding of this parameter has changed over time to support more encoder types than were originally envisioned when parameter was first defined. Bit 12 is used to identify which encoding is active.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0-3</td> <td>Encoder hardware to use:</td> </tr> <tr> <td>0</td> <td>No load encoder present</td> </tr> <tr> <td>1</td> <td>Primary (differential) quad encoder</td> </tr> <tr> <td>2</td> <td>Analog encoder</td> </tr> <tr> <td>3</td> <td>Secondary quad encoder from input lines</td> </tr> <tr> <td>4</td> <td>Servo tube/analog halls</td> </tr> <tr> <td>5</td> <td>Resolver</td> </tr> <tr> <td>11</td> <td>EnDat absolute encoder</td> </tr> <tr> <td>12</td> <td>SSI serial encoder</td> </tr> <tr> <td>13</td> <td>BiSS absolute encoder</td> </tr> <tr> <td>14</td> <td>Various absolute encoders made by Sanyo Denki, Panasonic and Harmonic Drives</td> </tr> <tr> <td>15</td> <td>Harmonic Drives custom encoder</td> </tr> <tr> <td>4</td> <td>If set, linear encoder. If clear, rotary encoder.</td> </tr> </tbody> </table>	Bits	Meaning	0-3	Encoder hardware to use:	0	No load encoder present	1	Primary (differential) quad encoder	2	Analog encoder	3	Secondary quad encoder from input lines	4	Servo tube/analog halls	5	Resolver	11	EnDat absolute encoder	12	SSI serial encoder	13	BiSS absolute encoder	14	Various absolute encoders made by Sanyo Denki, Panasonic and Harmonic Drives	15	Harmonic Drives custom encoder	4	If set, linear encoder. If clear, rotary encoder.
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0x5E	0x45E	0x2231	R*	INT32	Load Encoder Velocity. Units: 0.1 encoder counts/s																														
0x5F	0x45F	0x2106	RF	9 or 14	Velocity Loop Output Filter. Bi-quad filter which acts on output of velocity loop. 9- or 14-word parameters, see Filter Coefficients .																														
0x60	0x460	0x2383:20	F	U16	<table border="1"> <tr> <td colspan="2">Motor Encoder Type:</td> </tr> <tr> <td>Value</td> <td>Meaning</td> </tr> <tr> <td>0</td> <td>Primary (differential) quad encoder.</td> </tr> <tr> <td>1</td> <td>No encoder (use motor back EMF for velocity estimation).</td> </tr> <tr> <td>2</td> <td>Analog encoder.</td> </tr> <tr> <td>3</td> <td>Secondary quad encoder from input lines.</td> </tr> <tr> <td>4</td> <td>Low frequency analog encoder.</td> </tr> <tr> <td>5</td> <td>Resolver.</td> </tr> <tr> <td>6</td> <td>Use digital hall signals for position & velocity estimates.</td> </tr> <tr> <td>7</td> <td>Analog encoder updated at current loop rate.</td> </tr> <tr> <td>8</td> <td>Custom encoder</td> </tr> <tr> <td>9</td> <td>Panasonic</td> </tr> <tr> <td>10</td> <td>SPI command (reserved for custom firmware use).</td> </tr> </table>	Motor Encoder Type:		Value	Meaning	0	Primary (differential) quad encoder.	1	No encoder (use motor back EMF for velocity estimation).	2	Analog encoder.	3	Secondary quad encoder from input lines.	4	Low frequency analog encoder.	5	Resolver.	6	Use digital hall signals for position & velocity estimates.	7	Analog encoder updated at current loop rate.	8	Custom encoder	9	Panasonic	10	SPI command (reserved for custom firmware use).				
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					11 EnDat	
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					13 BiSS	
					14 Serial encoders from Sanyo Denki, Tamagawa, Panasonic and HD systems.	
					15 Custom encoders from HD systems.	
					16 Simple analog potentiometer feedback.	
					17 Gurley virtual absolute encoder	
					18 Custom Encoder K	
					19 S2 custom encoder	
					20 Hiperface	
					21 Wire saving incremental encoder which outputs hall signals on encoder lines at power-up.	
					22 Sankyo absolute encoder	
					23 Custom HG absolute encoder	
					24 Digital inputs used as tertiary encoder inputs. Inputs configured as single ended or differential by using Digital Input Command Configuration (0xA8) . Not used in Desired State (0x24) modes 3, 13 and 23 (PWM or Digital Input Command Modes)	
0x61	0x461	0x2383:21	F	INT16	Motor Encoder Units. Value defines units used to describe linear motor encoders. Not used with rotary motors.	
					Value	Description
					0	Microns.
					1	Nanometers.
2	Millimeters.					
0x62	0x462	0x2383:23	F	INT32	Motor Encoder Counts/Rev. Units: Counts/rev. Used for rotary motors only. When resolver is used as motor feedback, sets resolution of interpolated position.	
0x63	0x463	0x2383:24	F	INT16	Motor Encoder Resolution. Linear motor only. Units: encoder units/count.	
0x64	0x464	0x2383:25	F	INT32	Motor Encoder Electrical Distance. Linear motor only. Units: encoder units/electrical cycle.	
0x65	0x465	0x2383:22	F	U16	Motor Encoder Direction. 0=normal, 1=reverse. Note: Change in direction will affect motor phasing.	
0x66	0x466	0x2383:26	F	U32	Encoder Index Marker Pulse Distance. Units: rotary, counts; linear, encoder units. Reserved for future use.	

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0x67	0x467	0x2383:28	F	INT16	Analog Encoder Shift Amount. This value gives number of bits of interpolation to be applied to an analog encoder. Encoder resolution with no interpolation (shift value of 0) is 4 encoder counts/encoder line. Setting this parameter to value of n would give total of $2^{(n+2)}$ counts/line.	
0x68	0x468	0x2402	R*	INT32	Captured Index Position. Units: counts. Provides position that axis was in when an index pulse was captured. Configured by setting bits in Position Capture Control Register (0x6C) , and status of captured data can be checked in Position Capture Status Register (0x6D) . Reading this variable resets <i>bits 0 & 3</i> of Position Capture Status Register (0x6D) .	
0x69	0x469	0x2232	R*	INT32	Unfiltered Motor Encoder Velocity. Units 0.1 counts/s.	
0x6A	0x46A	0x2113	RF	INT32	Commanded Current Ramp Limit. Units: mA/s. Used when running in Current (Torque) mode. Setting this to zero disables slope limiting.	
0x6B	0x46B	0x2108	RF	9 or 14	Velocity Loop Command Filter Coefficients. Biquad filter structure that acts on command input of velocity loop just after velocity & acceleration limiting. 9- or 14-word parameters, see Filter Coefficients .	
0x6C	0x46C	0x2400	RF	INT16	Position Capture Control Register. Sets up position capture based on index or home input. Bit-mapped as follows:	
					Bits	Description
					0	If set, Captured Index Position (0x68) is captured on rising edge of index input.
					1	If set, Captured Index Position (0x68) is captured on falling edge of index input.
					2	If set, Captured Index Position (0x68) value will not be overwritten by new position until it has been read. If clear, new positions will overwrite old positions.
					3, 4	Reserved.
					5	If set, Captured Home Position (0x10A) will be captured on active to inactive edge of home input switch. If clear, home position will be captured on inactive to active edge.
		If set, Captured Home Position (0x10A) will not be overwritten by new position until it has been read.				

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0x6D	0x46D	0x2401	R*	INT16	<p>Position Capture Status Register. This register shows status of index/home capture mechanism. Bit-mapped as follows:</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>If set, index position has been captured. Cleared when captured position is read.</td> </tr> <tr> <td>1-2</td> <td>Reserved.</td> </tr> <tr> <td>3</td> <td>If set, new index transition occurred when captured position was already stored. Depending on mode, new position may have been discarded or overwritten previously stored position.</td> </tr> <tr> <td>4</td> <td>If set, home position has been captured. Cleared when captured position is read.</td> </tr> <tr> <td>5-6</td> <td>Reserved.</td> </tr> <tr> <td>7</td> <td>If set, new home pin transition occurred when captured position was already stored. Depending on mode, new position may have been discarded or overwritten previously stored position.</td> </tr> <tr> <td>8</td> <td>If set, new high-speed capture data.</td> </tr> <tr> <td>9-10</td> <td>Reserved.</td> </tr> <tr> <td>11</td> <td>If set, high-speed capture overflow.</td> </tr> </tbody> </table>	Bits	Description	0	If set, index position has been captured. Cleared when captured position is read.	1-2	Reserved.	3	If set, new index transition occurred when captured position was already stored. Depending on mode, new position may have been discarded or overwritten previously stored position.	4	If set, home position has been captured. Cleared when captured position is read.	5-6	Reserved.	7	If set, new home pin transition occurred when captured position was already stored. Depending on mode, new position may have been discarded or overwritten previously stored position.	8	If set, new high-speed capture data.	9-10	Reserved.	11	If set, high-speed capture overflow.
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0x6E	0x46E	0x2383:34	F	INT16	Number of Resolver Cycles/Motor Rev. Used only with resolver feedback devices.																				
0x6F	0x46F	0x2140	RF	INT16	<p>PWM Mode and Status. Bit-mapped as follows:</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>If set, force bus clamping. If clear, disable bus clamping. If bit 1 set, this bit is ignored.</td> </tr> </tbody> </table>	Bits	Description	0	If set, force bus clamping. If clear, disable bus clamping. If bit 1 set, this bit is ignored.																
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0x70	0x470	0x2193:1	RF	3 -5	<p>Output 0 Configuration.</p> <p>For notes on Output numbering see Input/Output Numbering.</p> <p>Data type is dependent on configuration and uses 1- to 5-words.</p> <p>First word is bit-mapped configuration value. Remaining words give additional parameter data used by output pin. Typically, second and third words are used as 32-bit mask to identify which bit(s) in status register output should follow. If any selected bits in status register are set, then output will go active. If no selected bits are set, then output will be inactive.</p> <p>Output 0 may be programmed as sync output for use in synchronizing multiple drives. In this configuration, first word of this variable should be set to 0x0200 (i.e., only bit 9 is set) and remaining words should be set to zero. Note that only Output 0 has this feature. Attempting to program any other output pin as sync output will have no effect.</p> <p>The first word is bit-mapped as follows:</p> <table border="1"> <tr> <th>Bits</th> <th>Configuration</th> </tr> <tr> <td></td> <td>Define which internal register drives output. Acceptable values for these bits are as follows:</td> </tr> <tr> <td>Value</td> <td>Description</td> </tr> </table>	Bits	Configuration		Define which internal register drives output. Acceptable values for these bits are as follows:	Value	Description										
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ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description		
					0-4	0	Track bits in Event Status Register (0xA0) .
						1	Track bits in Latched Event Status Register (0xA1) .
						2	Track bits in Manual Output Control Register. See Output States and Program Control (0xAB) .
						3	Track bits in Trajectory Status Register (0xC9) .
						4	Go active if position is between the two positions specified in words 2, 3 (low) and 4, 5 (high). If bit 14 is set, commanded position is used. If bit 14 is clear, actual position is used.
						5	Go active on low to high crossing of position specified by words 2, 3. Stay high for number of ms specified by words 4, 5. If bit 14 is set, commanded position is used. If bit 14 is clear, actual position is used.
						6	Same as 5, but for high to low crossings.
						7	Same as 5 but for any crossing.
						8	Go active if motor phase angle (plus an offset) is between 0 and 180 degrees. Offset is set using first word of extra data in units of degrees.
						9	Pulse output each time a position is crossed from an array of positions stored in trace memory.
						10	Use output to trigger an external regen resistor.
						11	For EtherCAT drives, pulse on SYNC0 signal.
						16	Track Hardware Position Compare function on drives supporting it.
					17	Logical OR of function 0 and 2. Output will track both a set of	

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					<p>selected Event Status Register (0xA0) bits and Output States and Program Control (0xAB). Bits 14 and 15 of configuration also effect operation. If any of selected Event Status bits are set then output is active (if bit 14 is clear) or inactive (if bit 14 is set). If selected Event Status bits aren't active, then if Output States and Program Control (0xAB) bit is set then output is either active (bit 15 is clear) or inactive (bit 15 is set). If neither of those conditions is true, then output is either active (if bit 15 is set) or inactive (if bit 15 is clear).</p>
					<p>18 Firmware 2.98 and later. BEL drives only support this special mode in which output is configured as a brake which goes active for programmable time after which it starts to PWM with programmable on and off times. Word 2 of output configuration gives PWM on time in us. Word three gives PWM period in us. Word four is reserved, word 5 gives delay before PWM starts in ms.</p>
					<p>19 Output is active if drive is being disabled by STO input.</p>
					<p>5-7 Reserved.</p>
					<p>8 If set, invert normal active state of output. E.g. outputs that are normally active low become active high. For programmed control, see Output States and Program Control (0xAB).</p>
					<p>9 If set, program output as sync output. This bit is reserved for all output pins except pin 0.</p>
					<p>10-11 Reserved.</p>
					<p>12-13 Axis number for multi-axis drives.</p>
					<p>14-15 Usage depends on output function selected.</p>
					<p>Remaining words give additional parameter data used by output pin. Typically, second and third words are used as 32-bit bitmask to identify which</p>

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description		
					<p>bit(s) in Event Status Register (0xA0) output should follow. If any selected bits in Event Status Register (0xA0) are set, then output will go active. If no selected bits in Event Status Register (0xA0) are set then output will be inactive.</p> <p>Version 4.80 firmware added several advanced output pin configurations which required more parameter data. At that point support for optional 5-word configuration was added to firmware. For these output pin configurations, words 2 and 3 define one 32-bit parameter and words 4 and 5 define second 32-bit parameter.</p> <p>Output 0 may be programmed as sync output for use in synchronizing multiple drives. In this configuration, first word of this variable should be set to 0x0200 (i.e. only bit 9 is set) and remaining words should be set to zero.</p> <p>Note that only Output 0 has this feature. Attempting to program any other output as sync output will have no effect.</p>		
0x71	0x471	0x2193:2	RF	See text	Output 1 Configuration. See Output 0 Configuration (0x70) .		
0x72	0x472	0x 2193:3	RF	See text	Output 2 Configuration. See Output 0 Configuration (0x70) .		
0x73	0x473	0x 2193:4	RF	See text	Output 3 Configuration. See Output 0 Configuration (0x70) .		
0x74	0x474	0x 2193:5	RF	See text	Output 4 Configuration. See Output 0 Configuration (0x70) .		
0x75	0x475	0x 2193:6	RF	See text	Output 5 Configuration. See Output 0 Configuration (0x70) .		
0x76	0x476	0x 2193:7	RF	See text	Output 6 Configuration. See Output 0 Configuration (0x70) .		
0x77	0x477	0x 2193:8	RF	See text	Output 7 Configuration. See Output 0 Configuration (0x70) .		
0x78	0x478	0x 2192:1	RF	U16	<p>Input 0 Configuration. Assigns function to input pin. All values not listed below are reserved for future use.</p> <p>For notes on Input numbering see Input/Output Numbering.</p> <p>Sync Input function is only valid for high-speed input pins. In addition, input pins 2 & 3 of Accelus and Junus drives do not support this feature.</p>		
					Bits	Configuration	
					0-7	Value	Meaning

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
					0	No function
					1	Reserved for future use (no function).
					2	Reset drive on rising edge of input.
					3	Reset drive on falling edge of input.
					4*	Positive limit switch. Active high.
					5*	Positive limit switch. Active low.
					6*	Negative limit switch. Active high.
					7*	Negative limit switch. Active low.
					8*	Motor temperature switch. Active high.
					9*	Motor temperature switch. Active low.
					10*	Clear faults on rising edge, disable drive while high.
					11*	Clear faults on falling edge, disable drive while low.
					12*	Reset on rising edge, disable drive while high.
					13*	Reset on falling edge, disable drive while low.
					14*	Home switch. Active high.
					15*	Home switch. Active low.
					16*	Drive disable. Active high
					17*	Drive disable. Active low.
					18	Sync input on rising edge. If bit 8 is set, pin debounce time is used as sync offset in 0.1 us units.
					19	Sync input on falling edge. If bit 8 is set, pin debounce time is used as sync offset in 0.1 us units.
					20*	Halt motor. Active high.
					21*	Halt motor. Active low.
					22	Scale analog input. Active high.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
					23	Scale analog input. Active low.
					24*	High speed position capture on rising edge. Only for high speed inputs.
					25*	High speed position capture on falling edge. Only for high speed inputs.
					26	Count rising edges of input to indexer register. Register number identified by bits 8-11.
					27	Count falling edges of input to indexer register. Register number identified by bits 8-11.
					28*	Encoder fault input. Active high.
					29*	Encoder fault input. Active low.
					30-35	Reserved.
					36	Abort move on rising edge if greater than n counts from destination position. Number of counts n is stored in an index register identified by bits 8-11.
					37	Abort move on falling edge if greater than n counts from destination position. Number of counts n is stored in an index register identified by bits 8-11.
					38*	Mark HV loss on rising edge, disable while high.
					39*	Mark HV loss on falling edge, disable while low.
					40*	Update trajectory on rising edge.
					41*	Update trajectory on falling edge.
					42*	Clear faults & event latch on rising edge.
					43*	Clear faults & event latch on falling edge.
					44*	Disable simulated encoder output when low. Burst current position on encoder output on rising edge.

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0x79	0x479	0x2192:2	RF	U16	Input 1 Configuration. See Input 0 Configuration (0x78) .												
0x7A	0x47A	0x2192:3	RF	U16	Input 2 Configuration. See Input 0 Configuration (0x78) .												
0x7B	0x47B	0x2192:4	RF	U16	Input 3 Configuration. See Input 0 Configuration (0x78) .												
0x7C	0x47C	0x2192:5	RF	U16	Input 4 Configuration. See Input 0 Configuration (0x78) .												
0x7D	0x47D	0x2192:6	RF	U16	Input 5 Configuration. See Input 0 Configuration (0x78) .												
0x7E	0x47E	0x2192:7	RF	U16	Input 6 Configuration. See Input 0 Configuration (0x78) .												
0x7F	0x47F	0x2192:8	RF	U16	Input 7 Configuration. See Input 0 Configuration (0x78) .												
0x80	0x480	0x6503	F*	String	Drive Model Number.												
0x81	0x481	0x2384:1 or 0x1018:4	F*	U32	Drive Serial Number.												
0x82	0x482	0x2384:3	F*	INT16	Drive's rated Peak Current. Unit: 0.01 A.												
0x83	0x483	0x2384:4	F*	INT16	Drive's rated Continuous Current. Unit: 0.01 A												

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0x84	0x484	0x2384:14	F*	INT16	Current Corresponding to Max A/D Reading. Units: 0.01 A.
0x85	0x485	0x2384:11	F*	U16	PWM Period. Units: 10 ns.
0x86	0x486	0x2384:12	F*	U16	Drive Servo Period (PWM periods). Servo loop update period as a multiple of the current loop period.
0x87	0x487	None	F*	U16	Product Family. Identifies the drive product family. For specific drive hardware type, see Drive Hardware Type (0xAD) .
0x88	0x488	0x2384: 5	F*	INT16	Drive's rated Time at Peak Current. Units: ms. Maximum time for which drive is rated to output peak current.
0x89	0x489	0x2384:6	F*	INT16	Drive's rated Maximum Voltage. Units: 0.1 V. Maximum bus voltage rating.
0x8A	0x48A	0x2384:15	F*	INT16	Drive's rated Voltage Corresponding to Max A/D Reading. Units: 0.1 V.
0x8B	0x48B	0x2384:7	F*	INT16	Drive's rated Minimum Voltage. Units: 0.1 V. Minimum bus voltage rating.
0x8C	0x48C	0x2384:9	F*	INT16	Drive's rated Maximum Temperature. Units: degrees C.
0x8D	0x48D	0x2384:2	F*	String	Manufacturing info (date code) of drive
0x8E	0x48E	0x2384:16	F*	INT16	Analog Input Reference Scaling Factor. This is voltage applied to analog input which causes max A/D value on drive.
0x90	0x490	None	R	U32	Serial Port Baud Rate. Units: bits/s. <i>Defaults to 9600 at power up or reset.</i>
0x91	0x491	None	R*	INT16	Maximum number of data words allowed per binary command over serial interface.
0x92	0x492	0x21A0	F	String	Axis label string
0x93	None	None	F	U32	Reserved
0x94	0x494	0x2384:24	R*	INT16	Firmware Version Number. Version number consists of major and minor version number. Minor number passed in bits 0-7; major number passed in bits 8-15. Example: version 1.12 would be encoded 0x010C.
0x95	0x495	0x2421	F	String	Host Configuration State. Reserved for use by CME software.
0x96	0x496	0x2312	RF	INT16	Calibration Offset for Analog Input or Analog Reference. This voltage is added to analog reference input and is calibrated at factory to give zero reading for zero input voltage.
0x97	0x497	0x2384:10	F*	INT16	Hysteresis value for drive over temperature cut-out. Units: degrees C.
0x98	0x498	0x2330	RF	INT16	Function Generator Configuration. Configures drive's internal function generator, which can drive current, velocity or position loop. Bit-mapped as follows:

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					<p>the following values: 4 (function generator drives current loop); 14 (function generator drives velocity loop); 24 (function generator drives position loop in servo mode); 34 (function generator drives position loop in stepper mode).</p> <p>Note that if one-shot mode is selected, then after one period (two if invert is selected), function type will reset to zero.</p>	
0x99	0x499	0x2331	RF	U16	Function Generator Frequency. Units: Hz. Plus & AFS products support high-resolution mode. Units: 0.01 Hz. See bit 8 of Function Generator Configuration (0x98) .	
0x9A	0x49A	0x2332	RF	INT32	Function Generator Amplitude. Amplitude of signal generated by internal function generator. Units depend on operating mode:	
					Mode	Units
					Current	0.01 A.
					Velocity	0.1 encoder counts/s.
					Position	Encoder counts.
0x9B	0x49B	0x2333	RF	U16	Function Generator Duty Cycle (square wave only). Units: 0.1% (for instance, 1000 for 100%).	
0x9C	0x49C	0x2384:8	F*	U16	Hysteresis for Maximum Bus Voltage Cut-Out. Units: 0.1 V.	
0x9D	0x49D	0x2384:18	F*	U16	<p>PWM Dead Time at Continuous Current Limit. Units: CPU cycles.</p> <p>This parameter gives PWM dead time used at or above continuous current limit. Dead time below continuous current limit is defined by linear function of this parameter and PWM Dead Time at Zero Current (0x9F).</p>	
0x9E	0x49E	0x2384:17	F*	U16	<p>Drive Minimum PWM Off Time. Units: 10 ns.</p> <p>This parameter gives minimum amount of time for which all PWM outputs must be disabled for each current loop cycle.</p>	
0x9F	0x49F	0x2384:19	F*	U16	<p>PWM Dead Time at Zero Current. Units: CPU cycles.</p> <p>This parameter gives PWM dead time at zero current. Dead time above zero current is defined by linear function of this parameter and PWM Dead Time at Continuous Current Limit (0x9D).</p>	
0xA0	0x4A0	0x1002	R*	U32	Event Status Register. Bit-mapped as follows:	
					Bits	Description
					0	Short circuit detected

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					1 Drive over temperature
					2 Over voltage
					3 Under voltage
					4 Motor temperature sensor active
					5 Encoder power error
					6 Motor phasing error
					7 Current output limited
					8 Voltage output limited
					9 Positive limit switch active
					10 Negative limit switch active
					11 Enable input not active
					12 Drive is disabled by software
					13 Trying to stop motor
					14 Motor brake activated
					15 PWM outputs disabled
					16 Positive software limit condition
					17 Negative software limit condition
					18 Following Error Fault. A following error has occurred, and drive is in following error mode.
					19 Following Error Warning. Indicates position error is greater than position following warning.
					20 Drive is currently in reset condition
					21 Position has wrapped. Position variable cannot increase indefinitely. After reaching a certain value the variable rolls back. This type of counting is called position wrapping or modulo count
					22 Drive fault. Fault configured as latching in Fault Mask (0xA7) has occurred. Latched faults may be cleared using Latching Fault Status Register (0xA4) .
					23 Velocity limit (0x3A) has been reached
					24 Acceleration limit (0x36) has been reached
					25 Position Tracking. Position Loop Error (0x35) is outside of Following Error Fault Limit (0xBA) .
					26 Home switch is active
					27 In motion. Set if trajectory generator is running profile or Following Error Fault

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description						
					<p>Limit (0xBA) is outside tracking window. Clear when drive is settled in position.</p> <p>28 Velocity window. Set when velocity error is larger than programmed velocity window</p> <p>29 Phase not yet initialized. If drive is phasing with no Halls, this bit is set until drive has initialized its phase.</p> <p>30 Command fault. CANopen or EtherCAT master not sending commands or PWM command not present. Note: If <i>Allow 100% Output</i> option is enabled by setting Bit 3 of Digital Input Command Configuration (0xA8) this fault will not detect missing PWM command.</p> <p>31 Reserved.</p>						
0xA1	0x4A1	0x2181	R	U32	Latched Event Status Register. This is latched version of Event Status Register (0xA0) . Bits are set by drive when events occur. Bits are only cleared by writing to this parameter as explained below: When writing to Latched Event Status Register, any bit set will cause corresponding bit in register to be cleared. For example, to clear over voltage bit, write decimal 4 or 0x4 to register. To clear all bits, write 0xffffffff to register						
0xA2	0x4A2	0x2261	R*	INT16	Hall Input State. Lower three bits of returned value give present state of Hall input pins. Hall state is value of Hall lines AFTER ordering and inversions specified in Hall Wiring Configuration (0x52) have been applied.						
0xA3	0x4A3	None	R	U32	Drive test parameter. This parameter is reserved for use by Copley during drive test.						
0xA4	0x4A4	0x2183	R	U32	<p>Latching Fault Status Register. Bit-mapped to show which latching faults have occurred in drive. When latching fault has occurred, the <i>fault bit (bit 22)</i> of Event Status Register (0xA0) is set. Cause of fault can be read from this register.</p> <p>To clear fault condition, write a 1 to associated bit in this register. Events that cause drive to latch fault are programmable. See Fault Mask (0xA7) for details.</p> <table border="1"> <thead> <tr> <th colspan="2">Latched Faults</th> </tr> <tr> <th>Bits</th> <th>Fault Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Data flash CRC failure. This fault is considered fatal and cannot be cleared. This bit is read-only and will always be set. If drive detects corrupted flash data</td> </tr> </tbody> </table>	Latched Faults		Bits	Fault Description	0	Data flash CRC failure. This fault is considered fatal and cannot be cleared. This bit is read-only and will always be set. If drive detects corrupted flash data
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					values on startup it will remain disabled and indicate fault condition.
					1 Drive internal error. This bit is read-only and will always be set. If drive fails its power-on self-test, it will remain disabled and indicate fault condition.
					2 Short circuit. If set: programs drive to latch a fault when short circuit is detected on motor outputs. If clear: programs drive to disable outputs for 100 ms after short circuit and then re-enable.
					3 Drive over temperature. If set: programs drive to latch a fault when drive over temperature event happens. If clear: programs drive to re-enable as soon as it cools sufficiently from over temperature event.
					4 Motor over temperature. If set: programs drive to latch a fault when motor temperature sensor input activates. If clear: programs drive to re-enable as soon as over temperature input becomes inactive.
					5 Over voltage. If set: programs drive to latch a fault when excessive bus voltage is detected. If clear: programs drive to re-enable as soon as bus voltage is within normal range.
					6 Under voltage. If set: programs drive to latch a fault condition when inadequate bus voltage is detected. If clear: programs drive to re-enable as soon as bus voltage is within normal range.
					7 Feedback fault. If set: programs drive to latch a fault when feedback faults occur. Feedback faults occur if too much current is drawn from 5 V source on drive, resolver or analog encoder is disconnected, or resolver or analog encoder has levels out of tolerance.
					8 Phasing error. If set: programs drive to latch a fault when phasing errors occur. If clear: programs drive to re-enable when phasing error is removed.
					9 Following error. If set: programs the drive to latch a fault and disable drive when

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					<p>following error occurs. If clear: programs drive to abort current move and remain enabled when following error occurs.</p>
					10 If set: programs drive to latch a fault when output current is limited by I ² T algorithm.
					11 FPGA failure. This bit is read-only.
					12 Command input lost fault. If set: programs drive to latch a fault and disable when command input is lost.
					13 Unable to initialize internal drive hardware. This bit is read-only.
					14 If set, programs drive to latch a fault when there is safety circuit consistency check failure.
					15 If set, programs drive to latch a fault when drive is unable to control motor current.
					16 If set, programs drive to latch a fault when motor wiring is disconnected, see Open Motor Wiring Check Current (0x19D) .
					17 Reserved.
					18 Safe torque off active
0xA5	0x4A5	0x2191	RF	U16	<p>Input Pin Configuration Register. Some drives have one or more pull-up resistors associated with their general-purpose input pins. On these drives, state of pull-ups can be controlled by writing to this register.</p> <p>This register has one bit for each pull-up resistor available on drive. Setting bit causes resistor to pull any inputs connected to it up to high state when they are not connected. Bit 0 controls first pullup resistor on drive, bit 1 controls second pullup resistor, etc. Please refer to drive datasheet to determine how many pullup resistors are available for particular drive.</p> <p>On drives that allow groups of inputs to be configured as either single ended or differential, bit 8 controls this feature. Set bit 8 to 0 for single ended, 1 for differential.</p>
0xA6	0x4A6	0x2190	R*	U16	<p>Input Pin States. The 16-bit value returned by this command gives current state (high/low) of drive's input pins after debounce. Each bit represents one input as shown below. See also Input Pin States, 32-Bit (0x15C) for newer drives which support more than 16 input pins.</p>

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0xA7	0x4A7	0x2182	RF	U32	<p>Fault Mask. This variable is used to configure which drive events cause latching faults.</p> <p>Setting fault mask bit to 1 causes associated drive event to cause latching fault when it occurs. Setting fault mask bit to 0 disables fault latching on associated event.</p> <p>Latched faults may be cleared using Latching Fault Status Register (0xA4).</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Fault Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Data flash CRC failure. This bit is read-only and will always be set. If drive detects corrupted flash data values on startup it will remain disabled and indicate a fault condition.</td> </tr> <tr> <td>1</td> <td>Drive internal error. This bit is read-only and will always be set. If drive fails its power-on self-test, it will remain disabled and indicate a fault condition.</td> </tr> <tr> <td>2</td> <td>Short circuit. If set: programs drive to latch a fault when short circuit is detected on motor outputs. If clear: programs drive to disable outputs for 100 ms after short circuit and then re-enable.</td> </tr> </tbody> </table>	Bits	Fault Description	0	Data flash CRC failure. This bit is read-only and will always be set. If drive detects corrupted flash data values on startup it will remain disabled and indicate a fault condition.	1	Drive internal error. This bit is read-only and will always be set. If drive fails its power-on self-test, it will remain disabled and indicate a fault condition.	2	Short circuit. If set: programs drive to latch a fault when short circuit is detected on motor outputs. If clear: programs drive to disable outputs for 100 ms after short circuit and then re-enable.																										
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					3 Drive over temperature. If set: programs drive to latch a fault when drive over temperature event happens. If clear: programs drive to re-enable as soon as it cools sufficiently from over temperature event.
					4 Motor over temperature. If set: programs drive to latch a fault when motor temperature sensor input activates. If clear: programs drive to re-enable as soon as over temperature input becomes inactive.
					5 Over voltage. If set: programs drive to latch a fault when excessive bus voltage is detected. If clear: programs drive to re-enable as soon as bus voltage is within normal range.
					6 Under voltage. If set: programs drive to latch a fault when inadequate bus voltage is detected. If clear: programs drive to re-enable as soon as bus voltage is within normal range.
					7 Feedback fault. If set: programs drive to latch a fault when feedback faults occur. Feedback faults occur if too much current is drawn from 5 V source on drive, resolver or analog encoder is disconnected or resolver or analog encoder has levels out of tolerance.
					8 Phasing error. If set: programs drive to latch a fault when phasing errors occur. If clear: programs drive to re-enable when phasing error is removed.
					9 Following error. If set: programs drive to latch a fault and disable when following error occurs. If clear: programs drive to abort current move and remain enabled when following error occurs.
					10 If set: programs drive to latch a fault when output current is limited by I ² T algorithm.
					11 FPGA failure. This bit is read-only.
					12 Command input lost fault. If set: programs drive to latch a fault and disable when command input is lost.

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0xA8	0x4A8	0x2320	RF	INT16	<p>Digital Input Command Configuration. Defines configuration of digital input commands when drive is running in a mode that uses them as a control source.</p> <p>The lower 8 bits control PWM input configuration for controlling current and velocity modes. Upper 8 bits configure digital inputs when running in position mode.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>If set, use PWM in signed/magnitude mode. If clear, use PWM in 50% duty cycle offset mode.</td> </tr> <tr> <td>1</td> <td>If set, invert the PWM input.</td> </tr> <tr> <td>2</td> <td>If set, invert the sign input.</td> </tr> <tr> <td>3</td> <td>If set, allow 100% duty cycle. If clear, treat 100% duty cycle as zero command, providing measure of safety in case of controller failure or cable break.</td> </tr> <tr> <td>4</td> <td>If set, use PWM Input Frequency (0xB6) as deadband for PWM input. Note: Some newer products have dedicated parameter, PWM Input Deadband (0x13F) to hold deadband</td> </tr> <tr> <td>5</td> <td>If set, allow longer PWM periods (up to 50 ms).</td> </tr> <tr> <td>6</td> <td>For 8367 DSP products, setting this bit will cause Motor Hall Offset (0x4F) to be added to angle calculated in UV mode. For Plus & AFS products, see UV Configuration (0x180).</td> </tr> <tr> <td>7</td> <td>Reserved for future use.</td> </tr> </tbody> </table>	Bits	Description	0	If set, use PWM in signed/magnitude mode. If clear, use PWM in 50% duty cycle offset mode.	1	If set, invert the PWM input.	2	If set, invert the sign input.	3	If set, allow 100% duty cycle. If clear, treat 100% duty cycle as zero command, providing measure of safety in case of controller failure or cable break.	4	If set, use PWM Input Frequency (0xB6) as deadband for PWM input. Note: Some newer products have dedicated parameter, PWM Input Deadband (0x13F) to hold deadband	5	If set, allow longer PWM periods (up to 50 ms).	6	For 8367 DSP products, setting this bit will cause Motor Hall Offset (0x4F) to be added to angle calculated in UV mode. For Plus & AFS products, see UV Configuration (0x180) .	7	Reserved for future use.
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0xA9	0x4A9	0x2321	RF	INT32	<p>Digital Input Scaling Factor. This value gives amount of current to command at 100% PWM input. Scaling depends on what PWM input is driving:</p> <p>Current mode: 0.01 A Estimated Velocity: 0.01 RPM Velocity: 0.1 encoder counts/second</p> <p>In position mode scaling factor is a ratio of two 16-bit values. First word passed gives numerator and second word gives denominator. This ratio determines number of encoder units moved for each pulse (or encoder count) input.</p> <p>For example, a ratio of 1/3 would cause motor to move 1 encoder unit for every three input steps.</p> <p>When running in PWM position mode, scaling factor is single 32-bit integer which gives range of commanded position in encoder counts. Minimum PWM Pulse Width (0x13C) corresponds to an absolute position of 0, Maximum PWM Pulse Width (0x13D) corresponds to an absolute position equal to this scaling factor. Additionally, an offset may be added using Registration Offset for Pulse & Direction Mode (0x10F).</p>																														

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0xAA	0x4AA	0x2196	R*	U16	<p>Raw Input State. 16-bit value returned by this command gives current state (high/low) of drive's input pins. Unlike Input Pin States (0xA6), no debounce is applied when reading inputs using this variable.</p> <p>Bits are mapped in same order as Input Pin States (0xA6).</p>																		
0xAB	0x4AB	0x2194	R	U16	<p>Output States and Program Control. When read, this parameter gives active/inactive state of drive's general-purpose digital outputs. Each bit represents an input number. Bit 0 = digital output 0 (OUT1), bit 1 = output 1 (OUT2), etc., up to output n (OUT(n+1)), number of digital outputs on drive. Additional bits are ignored.</p> <p>Outputs that have not been configured for external register control can be set by writing to this parameter (0x70 - 0x77). Set bit to activate output. It will be activated high or low according to how it was programmed (Bit 8 of 0x70-0x77). Clear bit to make output inactive. If an output was configured for internal register control, it will not be affected.</p>																		
0xAC	0x4AC	0x2180	R*	U32	<p>Sticky Drive Event Status Register. This read-only parameter is bit-mapped in exactly same way as Event Status Register (0xA0), but instead of giving present status of drive, sticky version indicates any bits in event status that have been set since last reading of sticky register.</p> <p>Sticky register is similar to Latched Event Status Register (0xA1), but latched register must be cleared explicitly, whereas sticky register is cleared automatically each time it is read.</p>																		
0xAD	0x4AD	0x1018:2 or 0x2384:13	F*	INT16	<p>Drive Hardware Type. Also known as Product Code. Identifies specific drive model. This is an augmented version of Product Family (0x87).</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Product</th> </tr> </thead> <tbody> <tr> <td>0x0000</td> <td>ASC Accelus Card.</td> </tr> <tr> <td>0x0001</td> <td>ASP Accelus panel without pullup/pulldown on inputs</td> </tr> <tr> <td>0x0002</td> <td>ASP Accelus panel with pullup/pulldown on input pins</td> </tr> <tr> <td>0x0100</td> <td>JSP Junus Panel</td> </tr> <tr> <td>0x0200</td> <td>ACM Accelnet Module</td> </tr> <tr> <td>0x0201</td> <td>XSL Xenus Panel (Legacy)</td> </tr> <tr> <td>0x0209</td> <td>ACJ Accelnet Micro Panel</td> </tr> <tr> <td>0x0210</td> <td>ACJ-S Accelnet Micro Panel Sin/Cos</td> </tr> </tbody> </table>	Value	Product	0x0000	ASC Accelus Card.	0x0001	ASP Accelus panel without pullup/pulldown on inputs	0x0002	ASP Accelus panel with pullup/pulldown on input pins	0x0100	JSP Junus Panel	0x0200	ACM Accelnet Module	0x0201	XSL Xenus Panel (Legacy)	0x0209	ACJ Accelnet Micro Panel	0x0210	ACJ-S Accelnet Micro Panel Sin/Cos
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ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					0x020C ACK Accelnet Micro Module
					0x0240 STM Stepnet Module
					0x0242 STP Stepnet Panel
					0x0243 STL Stepnet Micro Module
					0x0300 ASP-X2 2-axis Accelus panel (Obsolete)
					0x0310 XSJ Xenus Micro (Obsolete)
					0x0314 XSJ Rev 01 Xenus Micro AFS
					0x0320 XTL-R Xenus Resolver (Obsolete)
					0x0324 XTL-R Rev 01 Xenus Resolver AFS
					0x0330 XTL Xenus (Obsolete)
					0x0334 XTL Rev 01 Xenus AFS
					0x0340 XSJ-R Xenus Micro Resolver (Obsolete)
					0x0344 XSJ-R Rev 01 Xenus Micro Resolver AFS
					0x0350 STX Stepnet AC (Obsolete)
					0x0354 STX Rev 01 Stepnet AC AFS
					0x0360 ACJ-R Accelnet Micro Panel Resolver (Obsolete)
					0x0370 ACK-R Accelnet Micro Module Resolver (Obsolete)
					0x0380 AEP Accelnet EtherCAT Panel (Obsolete)
					0x0390 AMP Accelnet Macro Panel (Obsolete)
					0x03A0 ADP Accelnet Panel (Obsolete)
					0x03A4 ADP Rev 01 Accelnet Panel AFS
					0x03B0 ST3 3-axis Stepnet (Obsolete)
					0x03C0 800-1638 Custom drive (Obsolete)
					0x03D0 ADP-R Accelnet Panel Resolver (Obsolete)
					0x03E0 ACM-R Accelnet Module (Obsolete)
					0x03F0 ACK Accelnet Micro Module AFS
					0x0404 CAN I/O Rev 01 Module
					0x1000 XEL Xenus Plus EtherCAT (Obsolete)
					0x1001 XEL Xenus Plus EtherCAT
					0x1008 XEL-R Xenus Plus EtherCAT Resolver
					0x1010 XML Xenus Plus MACRO
					0x1020 XPL Xenus Plus CAN
					0x1030 AEM Accelnet Plus EtherCAT Module
					0x1040 APM Accelnet Plus CAN module
					0x1050 AE2 2-axis Accelnet Plus EtherCAT module

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					0x1060 AP2 2-axis Accelnet Plus CAN module
					0x1070 SEM Stepnet Plus EtherCAT module
					0x1080 SPM Stepnet Plus CAN module
					0x1090 SE2 2-axis Stepnet Plus EtherCAT module
					0x10A0 SP2 2-axis Stepnet Plus CAN module
					0x10B0 XE2 2-axis Xenus Plus EtherCAT
					0x10C0 BE2 2-axis Accelnet Plus EtherCAT Panel
					0x10D0 XP2 2-axis Xenus Plus CAN
					0x10E0 BP2 2-axis Accelnet Plus EtherCAT Panel
					0x10F0 TE2 2-axis Stepnet Plus EtherCAT Panel
					0x1100 TP2 2-axis Stepnet Plus CAN Panel
					0x1110 BEL Accelnet Plus EtherCAT Panel
					0x1120 BPL Accelnet Plus CAN Panel
					0x1130 TEL Stepnet Plus EtherCAT Panel
					0x1150 SP4 4-axis Stepnet CAN Module
					0x1170 XM2 2-axis Xenus Plus MACRO
					0x1180 BML Accelnet Plus MACRO
					0x1190 SE4 4-axis Stepnet EtherCAT Module
					0x11B0 XEC Xenus Plus Compact EtherCAT
					0x11C0 XPC Xenus Plus Compact CAN
					0x11D0 ME3 3-axis Module EtherCAT
					0x11E0 MP3 3-axis Module CANopen
					0x11F0 ME4 4-axis Module EtherCAT
					0x1200 MP4 4-axis Module CANopen
					0x1240 GEM Argus Plus EtherCAT Module
					0x1248 GEM Argus Plus EtherCAT Resolver
					0x1250 GPM Argus Plus CAN Module
					0x1258 GPM-R Argus Plus CAN Resolver
					0x1260 AEV Accelnet Plus Micro EtherCAT Module
					0x1270 APV Accelnet Plus Micro CAN Module
					0x1280 AEZ Panel
					0x1290 APZ Panel
					0x2050 IES Integrated Servo Drive
0xAE	0x4AE	0x60F6:3	RF	INT16	Current Loop Offset. Units: 0.01 A. This value is added to commanded motor current. It can compensate for directional bias affecting current loop.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0xAF	0x4AF	0x2420	RF	INT32	Miscellaneous Drive Options Register. Bit-mapped as follows:	
					Bits	Option
					0	If set, input pins 1, 2 and 3 are pulled high on drive. If clear, pins are not pulled up. Only available on Junus drive.
					1	Reserved.
					2	If set, limit switch inputs will only abort trajectory in progress but will not affect current output. If clear, limit switches limit current.
					3	If set, save PDO configuration to file in CVM file system when "Save to Flash" command is received over CANopen network. If clear, PDO is not saved.
					4	If set, limit switch activation will be treated as fault in CANopen Status Word (CANopen index 0x6041 as described in <i>CANopen Programmer's Manual</i>).
					5-6	When encoder wrap is enabled, these bits control direction of motion for absolute moves in trapezoidal and S-curve profile modes. 0 – move in the shortest direction 1 – Always move in positive direction 2 – Always move in negative direction 3 – reserved.
					7	If set, analog command values will use digital data written to an SPI serial interface connected to drive input pins & multimode port. This is available on some plus drives for use in digitally interfacing with a Delta Tau controller.
					8	If set, brake delay will be applied even in case of latching faults.
9-31	Reserved					
0xB0	0x4B0	0x2260	R	INT16	Motor Phase Angle. Units: degrees. Writes are only useful when running in diagnostic micro-stepping mode.	
0xB1	0x4B1	0x21C1	RF	INT16	Increment Rate for Phase Angle When In Micro Stepping Mode. Units: degrees/s. Only used in diagnostic mode. Desired State (0x24) = 42 (microstepping mode).	

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0xB2	0x4B2	0x21C0	RF	U16	Commutation Mode. Also known as Phasing Mode. Controls mechanism used by drive to compute motor phasing angle. Determines what inputs drive uses to initialize and maintain phase angle. Bit-mapped as follows:	
					Value	Mode
					0	Standard mode. Encoder-based sinusoidal commutation for brushless motors. Use digital Hall inputs to initialize phase, then switch to an encoder to maintain phase. Encoder is primary sensing device with Hall Effect sensors used to monitor and adjust phase angle as necessary during operation.
					1	Trapezoidal (Hall based) phasing. Hall Effect sensors are used for phasing at all times. This mode can be used if no encoder is available.
					2	Like mode 0 except that phase angle is not adjusted based on Hall inputs. Hall Effect sensors are still required to initialize phase angle at startup.
					3	Analog Halls (90 degrees). Only available on drives with necessary analog Hall inputs.
					4	DC brush motor mode. Note preferred way to configure an axis to drive DC brushed motor is by setting Motor Type (0x40) . This method will continue to be supported for backward compatibility however.
					5	Algorithmic Phase Initialization mode (wake & wiggle, no Halls). See <i>CME User Guide</i> for more information on Algorithmic Phase Initialization.
					6	Encoder based phasing. Use with resolver or Servo-Tube motors.
7	Trapezoidal commutation with phase angle interpolation.					
0xB3	0x4B3	0x2384:23	F*	INT16	Analog Encoder Scaling Factor. This parameter selects resolution of analog encoder input. Parameter not used for other encoder types.	
0xB4	0x4B4	0x2263	R*	INT16	Encoder Phase Angle. For feedback types, such as resolver, that can also calculate phase angle information. This parameter allows phase information to be read directly.	

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
0xB5	0x4B5	0x2353	R*	INT32	Homing Adjustment. Units: counts. This parameter is updated after each successful homing operation. Value contained is size of actual position adjustment made in last home sequence.
0xB6	0x4B6	0x2322	RF	U16	PWM Input Frequency. This is frequency of PWM for use in UV commutation mode only. Units: 10 Hz. This parameter is also used to specify an optional PWM dead band when running in normal (not UV) PWM command modes. When used as deadband value, this input should be set in range 0 to 32767 which corresponds to deadband of 0 to 100% of PWM duty cycle. On Plus and AFS models, PWM Input Deadband (0x13F) is dedicated to holding PWM Input Deadband value. On products supporting that parameter, writing to this parameter will still modify deadband setting for backward compatibility but use of PWM Input Deadband (0x13F) is recommended.
0xB7	0x4B7	0x2141	R*	U32	System Time. Time since start up. Units: ms.
0xB8	0x4B8	0x607D:2	RF	INT32	Positive Software Limit value. Units: counts. This parameter is only available on drives that support trajectory generation and homing. Software limits are only in effect after drive has been referenced (i.e. homing has been successfully completed). Set to less than negative software limit to disable.
0xB9	0x4B9	0x607D:1	RF	INT32	Negative Software Limit. Units: counts. Software limits are only in effect after drive has been referenced (i.e. homing has been successfully completed). Set to greater than positive software limit to disable.
0xBA	0x4BA	0x2120	RF	INT32	Following Error Fault Limit. Units: counts. If Position Loop Error (0x35) exceeds this value then <i>following error (bit 18)</i> of Event Status Register (0xA0) is set and motor is stopped. Using Fault Mask (0xA7) , following error event can be configured to either disable drive immediately or abort present move and continue holding position.
0xBB	0x4BB	0x6065	RF	INT32	Following Error Warning Limit. Units: counts. If Position Loop Error (0x35) exceeds this value then <i>following warning (bit 19)</i> of Event Status Register (0xA0) is set.
0xBC	0x4BC	0x6067	RF	INT32	Position Tracking Window Limit. Units: counts. If Position Loop Error (0x35) exceeds this value then <i>tracking window (bit 25)</i> of Event Status Register (0xA0) is set.
0xBD	0x4BD	0x6068	RF	U16	Time Delay For Following Error Fault Limit (0xBA) . Units: ms.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description						
					<i>Tracking window (bit 25) of Event Status Register (0xA0) will not be cleared until Position Loop Error (0x35) has been within Following Error Fault Limit (0xBA) for at least this long.</i>						
0xBE	0x4BE	0x2253	RF	U32	Deceleration limit used with software limits. Set to 0 for non-trajectory based software limits.						
0xBF	0x4BF	0x2351	RF	U16	Home to Hard Stop Delay Time. Units: ms. When performing home to hard stop, drive will push against stop for this long before sampling home position.						
0xC0	0x4C0	None	R*	INT16	CAN Network Node ID. This is drive's present ID as read at system startup. Node ID is only read at system startup, so this value will not change unless drive is reset. See CAN Network Node ID Configuration (0xC1) .						
0xC1	0x4C1	0x21B0	RF	INT16	<p>CAN Network Node ID Configuration. Defines how drive's Node ID is calculated and specifies drive's network bit rate. Node ID is calculated at startup (and only at startup) using a combination of general-purpose input pins and programmed offset value. On certain models, an address switch is also used. Resulting value is clipped to a 7-bit ID in range 0 to 127.</p> <p>For EtherCAT, this parameter can optionally hold network alias value to be loaded into ESC at power-up. See Network Options (0x121) for details. Plus drives with firmware 2.82 or greater have an optional new method of setting Node IDs on multi-axis drives. This new method allows each axis to be assigned its own ID, and Node IDs don't have to be consecutive. See descriptions of parameters Input Pin Mapping, Node ID Selection (0x103) and Network Options (0x121) for details of this new method.</p> <p>For multi-axis CANopen drives, first axis Node ID is set using this parameter. Subsequent axes are assigned consecutive Node ID's. For example, if first axis were given Node ID 7 using this parameter, second would be Node 8, third would be Node 9, etc. Bit-mapped as follows:</p> <table border="1" data-bbox="852 1472 1524 1736"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-6</td> <td>Give Node ID offset value that will be added to value read from input pins</td> </tr> <tr> <td>7</td> <td>Used only on DeviceNet firmware. If set, drive will be software disabled on startup and will remain disabled until enabled by DeviceNet I/O message with enable bit set.</td> </tr> </tbody> </table>	Bits	Description	0-6	Give Node ID offset value that will be added to value read from input pins	7	Used only on DeviceNet firmware. If set, drive will be software disabled on startup and will remain disabled until enabled by DeviceNet I/O message with enable bit set.
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					<p>1 Move in direction specified by bit 4 until limit switch is encountered. Then move in other direction out of limit. If bit 5 is clear, then edge location is home. If bit 5 is set, then next index pulse is home. Bit 6 not used in this mode.</p>
					<p>2 Home on constant home switch. Initial move is made in direction specified by bit 4. When home switch is encountered, direction is reversed. If bit 5 is clear, edge of home switch is set as home. If bit 5 is set, then an index pulse is used as home position. Bit 6 is used to define which index pulse is used.</p>
					<p>3 Home on intermittent home switch. This mode works same as mode 2 except that if limit switch is encountered when initially searching for home, then direction is reversed. In mode 2, hitting limit switch before finding home would be considered an error. Bit 8 identifies which edge of home to search for (positive or negative).</p>
					<p>4 Home to a hard stop. This moves in the direction specified in bit 4 until home current limit is reached. It then presses against hard stop using that current value until home delay time expires. If bit 5 (index) is set, drive away from the hard stop until an index is found.</p>
					<p>5-14 Reserved for future</p>
					<p>15 Immediate home. This value causes the amp to be referenced immediately on power-up. Once encoder is initialized, home offset value is added to encoder position and</p>

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					<p>result is set as current referenced position. This is primarily useful with absolute encoders.</p> <p>4 Initial move direction (0=positive, 1=negative).</p> <p>5 Home on index pulse if set.</p> <p>6 Selects which index pulse to use. If set, use pulse on DIR side of sensor edge. DIR is direction specified by bit 4 of this word.</p> <p>7 If set, capture falling edge of index. If clear, capture rising edge.</p> <p>8 When using momentary home switch, this bit identifies which edge of home switch to reference on. If set, use negative edge. If clear, use positive edge.</p> <p>9 If set, move to zero position when homing is finished. If clear, zero position is found, but not moved to.</p> <p>10 If set, homing sequence will run as normal, but actual position will not be adjusted at end of homing. Note that even though actual position is not adjusted, Homing Adjustment (0xB5) is updated with size of adjustment (in counts) that would have been made. Also, if bit 10 is set then no move to zero is made regardless of setting of bit 9.</p> <p>11 If this bit is set, at end of home routine home configuration stored in flash will be set to 15, and home offset stored in flash will be updated to correct value necessary to calibrate an absolute encoder based on most recent home operation. This bit is used to automate calibration of absolute encoders.</p>
0xC3	0x4C3	0x6099:1	RF	INT32	Homing Velocity (fast moves). Units: 0.1 counts/s. This velocity value is used during segments of homing procedure that may be handled at high speed. Generally, this means moves in which home sensor is being located, but edge of sensor is not being found.
0xC4	0x4C4	0x6099:2	RF	INT32	Homing Velocity (slow moves). Units: 0.1 counts/s. This velocity value is used for homing segments that

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
					require low speed, such as cases where edge of a homing sensor is being sought.	
0xC5	0x4C5	0x609A	RF	U32	Homing Acceleration/Deceleration. Units: 10 counts/s ² . This value defines acceleration used for all homing moves. Same value is used at beginning and ending of moves (i.e. no separate deceleration value).	
0xC6	0x4C6	0x607C	RF	INT32	Home Offset. Units: counts. Home offset is difference between zero position for application and machine home position (found during homing). Once homing is completed, new zero position determined by homing state machine will be located sensor position plus this offset. All subsequent absolute moves shall be taken relative to this new zero position.	
0xC7	0x4C7	0x2350	RF	INT16	Homing Current Limit. Units: 0.01 A. Used in Home to Hard Stop mode only, this current is used to determine when drive has reached end of travel (hard stop). Used in conjunction with Home to Hard Stop Delay Time (0xBF) .	
0xC8	0x4C8	None	RF	INT16	Trajectory Profile Mode. To set profile in CANopen see CAN object 0x6086 in <i>CANopen Programmers Manual</i> . Bit-mapped as follows:	
					Bits	Description
					0-2	Give trajectory profile mode. Possible trajectory modes are described below.
						Value
0	Trapezoidal profile mode. Uses position/distance, velocity, acceleration and deceleration. Any parameters may be changed during move. Jerk is not used in this mode.					
1	S-curve profile mode. Uses position/distance, velocity, acceleration, and jerk. No parameters may be changed while move is in progress (although move may be aborted). Acceleration parameter will be used for deceleration.					

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					<table border="1"> <tr> <td>2</td> <td>Velocity mode. Uses velocity, acceleration, and deceleration. Jerk is not used in this mode, and position is only used to define direction of move (zero or positive to move with a positive velocity, negative to move with a negative velocity). Any parameter may be changed during move. Set velocity to zero to stop.</td> </tr> <tr> <td>3</td> <td>PVT profile mode. Use of this mode through serial interface is not presently supported.</td> </tr> <tr> <td>8</td> <td>If set, relative move. If clear, absolute move.</td> </tr> </table>	2	Velocity mode. Uses velocity, acceleration, and deceleration. Jerk is not used in this mode, and position is only used to define direction of move (zero or positive to move with a positive velocity, negative to move with a negative velocity). Any parameter may be changed during move. Set velocity to zero to stop.	3	PVT profile mode. Use of this mode through serial interface is not presently supported.	8	If set, relative move. If clear, absolute move.												
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0xC9	0x4C9	0x2252	R*	INT16	<p>Trajectory Status Register. This parameter gives status information about the trajectory generator. Bit-mapped as follows:</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-8</td> <td>Reserved.</td> </tr> <tr> <td>9</td> <td>Cam table underflow.</td> </tr> <tr> <td>10</td> <td>Reserved.</td> </tr> <tr> <td>11</td> <td>Homing error. If set, an error occurred in last home attempt. Cleared by a home command.</td> </tr> <tr> <td>12</td> <td>Referenced. Set when homing command has been successfully executed. Cleared by home command.</td> </tr> <tr> <td>13</td> <td>Homing. If set, drive is running home command.</td> </tr> <tr> <td>14</td> <td>Set when move is aborted. Cleared at start of next move.</td> </tr> <tr> <td>15</td> <td>In-Motion Bit. If set, trajectory generator is presently generating profile.</td> </tr> </tbody> </table>	Bits	Description	0-8	Reserved.	9	Cam table underflow.	10	Reserved.	11	Homing error. If set, an error occurred in last home attempt. Cleared by a home command.	12	Referenced. Set when homing command has been successfully executed. Cleared by home command.	13	Homing. If set, drive is running home command.	14	Set when move is aborted. Cleared at start of next move.	15	In-Motion Bit. If set, trajectory generator is presently generating profile.
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0xCA	0x4CA	0x607A	RF	INT32	<p>Trajectory Generator Position Command. Units: Counts. This value gives destination position for absolute moves or move distance for relative moves.</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>Relative</td> <td>Move distance.</td> </tr> <tr> <td>Absolute</td> <td>Target position.</td> </tr> <tr> <td>Velocity</td> <td>Direction: 1 for positive, -1 for negative.</td> </tr> </tbody> </table>	Type	Meaning	Relative	Move distance.	Absolute	Target position.	Velocity	Direction: 1 for positive, -1 for negative.										
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0xCB	0x4CB	0x6081	RF	INT32	Trajectory Maximum Velocity. Trajectory generator will attempt to reach this velocity during a move. Units: 0.1 counts/s.
0xCC	0x4CC	0x6083	RF	U32	Trajectory Maximum Acceleration. Units: 10 counts/s ² . Trajectory generator will attempt to reach this acceleration during a move. For s-curve profiles, this value also used to decelerate at end of move.
0xCD	0x4CD	0x6084	RF	U32	Trajectory Maximum Deceleration. Units: 10 counts/s ² . In trapezoidal trajectory mode, this value used to decelerate at end of move.
0xCE	0x4CE	0x2121	RF	U32	Trajectory Maximum Jerk. Units: 100 counts/s ³ . Also known as Trajectory Jerk Limit. S-curve profile generator uses this value as jerk (rate of change of acceleration/deceleration) during moves. Other profiles types do not use jerk limit.
0xCF	0x4CF	0x6085	RF	U32	Trajectory Abort Deceleration. Units: 10 counts/s ² . If move is aborted, this value will be used by trajectory generator to decelerate to stop.
0xD0	0x4D0	0x2192:9	RF	U16	Input 8 Configuration. See Input 0 Configuration (0x78) .
0xD1	0x4D1	0x2192:10	RF	U16	Input 9 Configuration. See Input 0 Configuration (0x78) .
0xD2	0x4D2	0x2192:11	RF	U16	Input 10 Configuration. See Input 0 Configuration (0x78) .
0xD3	0x4D3	0x2192:12	RF	U16	Input 11 Configuration. See Input 0 Configuration (0x78) .
0xD4	0x4D4	0x2192:13	RF	U16	Input 12 Configuration. See Input 0 Configuration (0x78) .
0xD5	0x4D5	0x2192:14	RF	U16	Input 13 Configuration. See Input 0 Configuration (0x78) .
0xD6	0x4D6	0x2192:15	RF	U16	Input 14 Configuration. See Input 0 Configuration (0x78) .
0xD7	0x4D7	0x2192:16	RF	U16	Input 15 Configuration. See Input 0 Configuration (0x78) .
0xD8	0x4D8	0x2150	RF	U16	Regen Resistor Resistance. Units: 0.1 Ω.
0xD9	0x4D9	0x2151	RF	U16	Regen Resistor, Continuous Power. Units: W.
0xDA	0x4DA	0x2152	RF	U16	Regen Resistor, Peak Power. Units: W.
0xDB	0x4DB	0x2153	RF	U16	Regen Resistor, Time at Peak. Units: ms.
0xDC	0x4DC	0x2154	RF	INT16	Regen Turn on Voltage Units: 0.1 V.
0xDD	0x4DD	0x2155	RF	INT16	Regen Turn off Voltage. Units: 0.1 V.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0xDE	0x4DE	0x2384:20	F*	INT16	Drive's Peak Current Rating for Internal Regen Transistor. Units: 0.01 A.	
0xDF	0x4DF	0x2384:21	F*	INT16	Drive's Continuous Current Rating for Internal Regen Transistor. Units: 0.01 A.	
0xE0	0x4E0	0x2384:22	F*	INT16	Drive's Time at Peak Current for Internal Regen Transistor. Units: ms.	
0xE1	0x4E1	0x2156	F	String	Regen Resistor Model Number String.	
0xE2	0x4E2	0x2157	R*	INT16	Regen Resistor Status. Bit-mapped as follows:	
					Bits	Description
					0	Set if regen circuit is currently closed.
					1	Set if regen is required based on bus voltage.
					2	Set if regen circuit is open due to an overload condition. Overload may be caused by either resistor settings or internal drive protections.
3-15	Reserved.					
0xE3	0x4E3	0x2382	RF	U16	Position Loop Output Gain Multiplier. Output of position loop is multiplied by this value before being passed to velocity loop. This scaling factor is calculated such that a value of 100 is a 1.0 scaling factor. This parameter is most useful in dual loop systems.	
0xE4	0x4E4	0x21C2	RF	INT16	Maximum Current to use with algorithmic phase initialization. See <i>Value 5</i> of Commutation Mode (0xB2) . Units: 0.01 A.	
0xE5	0x4E5	0x21C3	RF	U16	Algorithmic Phase Initialization Timeout. See <i>Value 5</i> of Commutation Mode (0xB2) . Units: ms.	
0xE6	0x4E6	0x21D8	RF	INT32	Max Step Rate. This is maximum velocity adjustment made by stepper outer position loop when enabled. This parameter is only used when stepper outer loop is engaged (<i>bit 1</i> of Stepper Configuration & Status (0xEE) is set). Units: 0.1 steps/s.	
0xE7	0x4E7	0x21D7	RF	U16	Proportional Gain (ECp) for Stepper Outer Loop. This parameter gives gain used for calculating velocity adjustment based on Position Loop Error (0x35) . This parameter is only used when stepper outer loop is engaged (<i>bit 1</i> of Stepper Configuration & Status (0xEE) is set).	
0xE8	0x4E8	0x21D0	RF	INT16	Holding Current for Microstepping Mode. Units: 0.01 A.	
0xE9	0x4E9	0x21D1	RF	U16	Run to Hold Time for Microstepping Mode. Units: ms.	

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0xEA	0x4EA	0x21D2	RF	U16	Detent Correction Gain Factor for Microstepping mode.	
0xEB	0x4EB	0x21D3	RF	U16	Damping Correction Gain Factor for Microstepping mode	
0xEC	0x4EC	0x21D4	RF	9 or 14	Damping Correction biquad filter structure for Microstepping mode. For details on encoding of filter structure, please see Filter Coefficients .	
0xED	0x4ED	0x21D5	RF	U16	Holding Current to Fixed Voltage Output Time for Microstepping Mode. Time delay from entering hold current before entering special voltage control mode of operation. This mode trades normal tight control of current for very low jitter on motor position. Used in stepper mode only. Set to 0 to disable this feature. Units: ms.	
0xEE	0x4EE	0x21D6	RF	INT16	Stepper Configuration & Status. Bit-mapped as follows:	
					Bits	Description
					0	Use encoder input for phase compensation if enabled. Pure stepper mode if disabled.
					1	Use outer position loop to adjust stepper position based on Position Loop Error (0x35) . When this bit is set, gain value Proportional Gain (ECp) (0xE7) is multiplied by Position Loop Error (0x35) and result is velocity that is added to Microstepping position limited by Max Step Rate (0xE6) .
2-15	Reserved.					
0xF0	0x4F0	0x2195:1	RF	U16	Debounce Time For Input 0. Units: ms.	
0xF1	0x4F1	0x2195:2	RF	U16	Debounce Time For Input 1. Units: ms.	
0xF2	0x4F2	0x2195:3	RF	U16	Debounce Time For Input 2. Units: ms.	
0xF3	0x4F3	0x2195:4	RF	U16	Debounce Time For Input 3. Units: ms.	
0xF4	0x4F4	0x2195:5	RF	U16	Debounce Time For Input 4. Units: ms.	
0xF5	0x4F5	0x2195:6	RF	U16	Debounce Time For Input 5. Units: ms.	
0xF6	0x4F6	0x2195:7	RF	U16	Debounce Time For Input 6. Units: ms.	
0xF7	0x4F7	0x2195:8	RF	U16	Debounce Time For Input 7. Units: ms.	
0xF8	0x4F8	0x2195:9	RF	U16	Debounce Time For Input 8. Units: ms.	
0xF9	0x4F9	0x2195:10	RF	U16	Debounce Time For Input 9. Units: ms.	
0xFA	0x4FA	0x2195:11	RF	U16	Debounce Time For Input 10. Units: ms.	
0xFB	0x4FB	0x2195:12	RF	U16	Debounce Time For Input 11. Units: ms.	

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0xFC	0x4FC	0x2195:13	RF	U16	Debounce Time For Input 12. Units: ms.																																				
0xFD	0x4FD	0x2195:14	RF	U16	Debounce Time For Input 13. Units: ms.																																				
0xFE	0x4FE	0x2195:15	RF	U16	Debounce Time For Input 14. Units: ms.																																				
0xFF	0x4FF	0x2195:16	RF	U16	Debounce Time For Input 15. Units: ms.																																				
0x100	0x500	0x2184	RF	U32	CANopen Limit Status Mask. This parameter defines which bits in Event Status Register (0xA0) can set limit bit (bit 11) of CANopen Status Word (CANopen index 0x6041 as described in <i>CANopen Programmer's Manual</i>). If Event Register Status (0xA0) and its corresponding Limit Mask bit are both set, then CANopen Status Word limit bit is set. If all selected Event Status Register (0xA0) bits are clear, then limit bit is clear.																																				
0x101	0x501	0x2197	R*	INT16	Network Address Switch Value. This gives current state of address switch. For drives without a switch, value returned is undefined.																																				
0x102	0x502	0x21B4	R*	INT16	Network Status Word. Bit-mapped as follows: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">CANopen</th> </tr> <tr> <th>Bits</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td rowspan="5">0-1</td> <td>CANopen node status. This field will take one of following values:</td> </tr> <tr> <td style="text-align: center;">Value</td> <td style="text-align: center;">Status</td> </tr> <tr> <td style="text-align: center;">0</td> <td>CANopen interface is disabled.</td> </tr> <tr> <td style="text-align: center;">1</td> <td>Stopped mode.</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Preoperational mode.</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Operational mode.</td> </tr> <tr> <td>4</td> <td>Set if CANopen SYNC message is missing.</td> </tr> <tr> <td>5</td> <td>Set on CANopen guard error.</td> </tr> <tr> <td>8</td> <td>Set if CAN port is in 'bus off' state.</td> </tr> <tr> <td>9</td> <td>Set if CAN port is in 'transmit error passive' state.</td> </tr> <tr> <td>10</td> <td>Set if CAN port is in 'receive error passive' state.</td> </tr> <tr> <td>11</td> <td>Set if CAN port is in 'transmit warning' state.</td> </tr> <tr> <td>12</td> <td>Set if CAN port is in 'receive warning' state.</td> </tr> <tr> <td>15</td> <td>Always clear for CANopen</td> </tr> <tr> <th colspan="2">DeviceNet</th> </tr> <tr> <th>Bits</th> <th>Meaning</th> </tr> </tbody> </table>	CANopen		Bits	Meaning	0-1	CANopen node status. This field will take one of following values:	Value	Status	0	CANopen interface is disabled.	1	Stopped mode.	2	Preoperational mode.	3	Operational mode.	4	Set if CANopen SYNC message is missing.	5	Set on CANopen guard error.	8	Set if CAN port is in 'bus off' state.	9	Set if CAN port is in 'transmit error passive' state.	10	Set if CAN port is in 'receive error passive' state.	11	Set if CAN port is in 'transmit warning' state.	12	Set if CAN port is in 'receive warning' state.	15	Always clear for CANopen	DeviceNet		Bits	Meaning
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0x103	0x503	0x21B1	F	U32	<p>Input Pin Mapping for Node ID Selection.</p> <p>When CAN Network Node ID Configuration (0xC1) indicates that 1 or more input pins will be used to select Node ID, this parameter is used to map input pins to ID bits.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0-3</td> <td>Identify the general-purpose input pin associated with ID bit 0.</td> </tr> <tr> <td>4-7</td> <td>Identify the general-purpose input pin associated with ID bit 1.</td> </tr> <tr> <td>8-11</td> <td>Identify the general-purpose input pin associated with ID bit 2.</td> </tr> <tr> <td>12-15</td> <td>Identify the general-purpose input pin associated with ID bit 3.</td> </tr> </tbody> </table>	Bits	Meaning	0-3	Identify the general-purpose input pin associated with ID bit 0.	4-7	Identify the general-purpose input pin associated with ID bit 1.	8-11	Identify the general-purpose input pin associated with ID bit 2.	12-15	Identify the general-purpose input pin associated with ID bit 3.																														
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0x105	0x505	0x2360	RF	U16	<p>Camming Configuration. Bit-mapped as follows. For more information, see <i>Copley Camming User Guide</i>.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-3</td> <td>ID Number of Cam Table to use (0-9).</td> </tr> <tr> <td>4</td> <td>Reserved.</td> </tr> <tr> <td>5</td> <td>If set, only allow forward motion through CAM table.</td> </tr> <tr> <td>6</td> <td>If set, use Camming Internal Generator. Internal generator runs at constant velocity programmed in Camming Master Velocity (0x109). If clear, use digital command input as configured in CME software camming controls or Input Pin States (0xA6).</td> </tr> <tr> <td>7</td> <td>If set, run tables stored in RAM. If clear, use tables stored in flash file system.</td> </tr> </tbody> </table>	Bits	Description	0-3	ID Number of Cam Table to use (0-9).	4	Reserved.	5	If set, only allow forward motion through CAM table.	6	If set, use Camming Internal Generator. Internal generator runs at constant velocity programmed in Camming Master Velocity (0x109) . If clear, use digital command input as configured in CME software camming controls or Input Pin States (0xA6) .	7	If set, run tables stored in RAM. If clear, use tables stored in flash file system.
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0x106	0x506	0x2361	RF	INT16	Camming delay, forward motion. Units: master command counts. This gives delay used when entering cam table in forward direction.																
0x107	0x507	0x2362	RF	INT16	Camming delay, reverse motion. Units: master command counts. This gives delay used when entering a cam table in reverse direction.																
0x108	0x508	None	R	INT16	Writing any value to this parameter will cause any CANopen PDO objects configured with type code 254 to be sent. This parameter is primarily useful for triggering a PDO from within CVM program. Reading this parameter does not return any useful information.																
0x109	0x509	0x2363	RF	INT 32	Camming Master Velocity. Units: 0.1 counts/s. Constant velocity of Camming Internal Generator.																
0x10A	0x50A	0x2403	R*	INT 32	Captured Home Position. Units: counts. Provides position that axis was in when an input pin configured as home switch input became active. Configured by setting bits in Position Capture Control Register (0x6C) . Status of captured data can																

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					be checked in Position Capture Status Register (0x6D) . Reading this variable resets bits 4 & 7 of Position Capture Status Register (0x6D) .
0x10B	0x50B	0x2422	R*	U32	Firmware Version Number (extended). Upper 16 bits give same major/minor version number as Firmware Version Number (0x94) . Lower 16 bits hold release number (upper byte) and reserved byte (lower).
0x10C	0x50C	0x1017	RF	U16	CANopen Heartbeat Time. Units: ms. Frequency at which drive will produce heartbeat messages. This parameter may be set to zero to disable heartbeat production. Note that only one of the two node-guarding methods may be used at once. If Heartbeat Time is non-zero, then heartbeat protocol is used regardless of settings of CANopen Node Guarding Time (0x10D) and CANopen Node Guarding Time Life Factor (0x10E) .
0x10D	0x50D	0x100C	RF	U16	CANopen Node Guarding Time. Units: ms. This parameter gives time between node-guarding requests that are sent from CANopen master to drive. Drive will respond to each request with node-guarding message indicating internal state of drive. If drive has not received node-guarding request within time period defined by product of Node Guarding Time and CANopen Node Guarding Life Time Factor (0x10E) , drive will treat this lack of requests as fault.
0x10E	0x50E	0x100D	RF	U8	CANopen Node Guarding Life Time Factor. This object gives multiple of CANopen Node Guarding Time (0x10D) . Drive expects to receive node-guarding request within time period defined by product of CANopen Node Guarding Time (0x10D) and Lifetime Factor. If drive has not received node-guarding request within this time, it treats lack of requests as fault.
0x10F	0x50F	0x2325	R	INT 32	Registration Offset for Pulse & Direction Mode. When running in pulse & direction mode (Desired State (0x24) = 23), this parameter may be used to inject an offset into master position. Offset will immediately be cleared once it has been applied to master position, so this parameter will normally be read back as zero when running in pulse and direction mode 23. When running in PWM position mode, offset value is added to absolute position calculated using Minimum PWM Pulse Width (0x13C) and Maximum PWM Pulse Width (0x13D) and Digital Input Scaling Factor (0xA9) .

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description																		
0x110	0x510	0x2404	R	INT 32	Time Stamp of Last High Speed Position Capture. Units: us. If high speed position capture is enabled, this parameter gives time of last capture. Setting this parameter causes drive to calculate its position at set time if position capture is enabled and time is recent enough for data to be available. Calculated position may be read from Captured Position for High Speed Position Capture (0x111) . This feature is mainly used when capturing position on multiple drives across network.																		
0x111	0x511	0x2405	R*	INT 32	Captured Position for High Speed Position Capture. Units: counts.																		
0x112	0x512	0x2242	R	INT 32	Load Encoder Position. Units: counts. This returns position of load encoder if configured. This is also passive load position when used in passive mode.																		
0x113	0x513	0x1015	RF	INT16	CANopen emergency inhibit time. Units: ms.																		
0x114	0x514	0x2381:5	RF	U16	Velocity Loop Drain (integral bleed). Range: 0 to 32767, Default: 0. Modifies effect of velocity loop integral gain. Higher Vi Drain value, faster integral sum is lowered.																		
0x115	0x515	0x2010	R	5 Words	Trajectory Buffer Access. This object can be used to load data into drive's internal trajectory buffer or send commands used to control buffer. Trajectory buffer holds trajectory segments used in PVT mode. Data passed to this parameter consists of a 16-bit command code, followed by up to two 32-bit parameters. First word passed to this parameter is bit-mapped. Data contained in this word identifies this access as either buffer command or trajectory segment to be loaded into buffer. If most significant bit of first word is set, then write is treated as command code. In this case no additional data is passed and first word is formatted as follows: <table border="1" data-bbox="852 1360 1518 1776"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-7</td> <td>Command data.</td> </tr> <tr> <td>8-9</td> <td>Command code.</td> </tr> <tr> <td>10-14</td> <td>Reserved.</td> </tr> <tr> <td>15</td> <td>Always set for buffer commands.</td> </tr> <tr> <td colspan="2">Following command values are supported:</td> </tr> <tr> <th>Value</th> <th>Description</th> </tr> <tr> <td>0</td> <td>Clear buffer and abort any move in progress.</td> </tr> <tr> <td>1</td> <td>Pop N most recently sent segments off buffer. PVT profiles will continue to run as</td> </tr> </tbody> </table>	Bits	Description	0-7	Command data.	8-9	Command code.	10-14	Reserved.	15	Always set for buffer commands.	Following command values are supported:		Value	Description	0	Clear buffer and abort any move in progress.	1	Pop N most recently sent segments off buffer. PVT profiles will continue to run as
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					<p>long as buffer doesn't underflow. Number of segments to pop (N) is passed in command data area. If there are less than N segments on buffer, this acts same as buffer clear, except that profile is not stopped except by underflow.</p> <p>To write data to trajectory buffer, most significant bit of first word must be clear. In this case, first word is formatted as follows:</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-7</td> <td>Segment time in ms.</td> </tr> <tr> <td>8-11</td> <td>Reserved.</td> </tr> <tr> <td>12</td> <td>Set for relative positions. clear for absolute positions.</td> </tr> <tr> <td>13-14</td> <td>Reserved.</td> </tr> <tr> <td>15</td> <td>Always zero for data writes.</td> </tr> </tbody> </table> <p>When writing new PVT segment to trajectory buffer, first word is always followed by a 32-bit position value. Position is specified in units of encoder counts and can be interpreted as either absolute or relative based on bit 12 of command word. Optionally, position can be followed by a 32-bit velocity value. Velocity is specified in units of 0.1 encoder counts/second. If velocity value is supplied, then drive will use cubic polynomial interpolation between points when running trajectory (PVT mode). If velocity is not supplied, then linear interpolation will be used (PT mode). It is acceptable to mix PVT and PT segments within same move.</p> <p>Reading this parameter always returns three words of status information about trajectory buffer. First returned word is formatted as follows:</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-7</td> <td>Number of free locations in trajectory buffer.</td> </tr> <tr> <td>8-15</td> <td>Reserved.</td> </tr> </tbody> </table> <p>Second two words are reserved for future use.</p>	Bits	Description	0-7	Segment time in ms.	8-11	Reserved.	12	Set for relative positions. clear for absolute positions.	13-14	Reserved.	15	Always zero for data writes.	Bits	Description	0-7	Number of free locations in trajectory buffer.	8-15	Reserved.
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0x116	0x516	0x605A	RF	INT16	CANopen Quick Stop Option code.																		
0x117	0x517	0x605B	RF	INT16	CANopen Shutdown Option code.																		
0x118	0x518	0x605C	RF	INT16	CANopen Disable Option code.																		
0x119	0x519	0x605D	RF	INT16	CANopen Halt Option code.																		
0x11A	0x51A	0x2080	F*	U32	<p>Drive Scaling Configuration. Defines units used for current and voltage readings from drive:</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> </tbody> </table>	Bits	Description																
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0x11B	0x51B	0x6082	R	INT32	Trajectory Ending Velocity. For use with trap profile mode, gives velocity at end of moves. Primarily used when linking multiple moves together.																								
0x11C	0x51C	0x2256	R	U32	<p>Trajectory Sequence Buffer Status. Trajectory sequence buffer is used in CANopen profile position mode and stores trajectory segments added using the 'set of setpoints' method described in the CANopen specification. This parameter allows trajectory status to be queried. It's bitmapped as follows:</p> <table border="1"> <tr> <th>Bits</th> <th>Description</th> </tr> <tr> <td>0-7</td> <td>Number of free locations in buffer</td> </tr> <tr> <td>8-15</td> <td>Number of full locations in buffer</td> </tr> <tr> <td>16-31</td> <td>Reserved</td> </tr> </table>	Bits	Description	0-7	Number of free locations in buffer	8-15	Number of full locations in buffer	16-31	Reserved																
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0x11D	0x51D	0x222B	RF	U32	<p>Encoder Error Filter Configuration. Encoder error filter can be used to detect and ignore bad position data from an encoder or temporary encoder errors. Bad encoder readings are detected by comparing an expected position (based on extrapolation of previous readings) and actual reading from encoder.</p> <table border="1"> <tr> <th>Bits</th> <th>Description</th> </tr> <tr> <td>0-3</td> <td>Maximum number of consecutive bad samples to ignore. If zero then filter is disabled.</td> </tr> <tr> <td>4-15</td> <td>Reserved</td> </tr> <tr> <td>16-27</td> <td>Maximum error between extrapolated reading and actual reading to consider reading bad</td> </tr> <tr> <td>28-31</td> <td>Reserved</td> </tr> </table>	Bits	Description	0-3	Maximum number of consecutive bad samples to ignore. If zero then filter is disabled.	4-15	Reserved	16-27	Maximum error between extrapolated reading and actual reading to consider reading bad	28-31	Reserved														
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0x11E	0x51E	0x222C	R	U32	Encoder Error Filter Status. This can be cleared by writing zero to it.																								

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0x120	0x520	0x2384:25	R*	INT16	Returns number of axis implemented by this drive.																												
0x121	0x521	0x21B3	RF	INT16	<p>Network Options. Configures drive's network. Details of its meaning depend on type of network implemented in drive.</p> <p>CANopen</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Must be clear to select CANopen networking.</td> </tr> <tr> <td>1-2</td> <td>Reserved.</td> </tr> <tr> <td>3</td> <td>If set, use an alternative method of assigning Node IDs to each axis. See Input Pin Mapping for Node ID Selection (0x103) for details</td> </tr> <tr> <td>4-7</td> <td>Reserved</td> </tr> <tr> <td>8</td> <td>If set, PDO mapping will be saved to flash when object 0x1010 is used to save drive state.</td> </tr> <tr> <td>9</td> <td>If set, PDO communications settings will be stored to flash when object 0x1010 is used to save drive state</td> </tr> <tr> <td>10-15</td> <td>Reserved</td> </tr> </tbody> </table> <p>DeviceNet</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Must be set to select DeviceNet networking.</td> </tr> <tr> <td>1-15</td> <td>Reserved.</td> </tr> </tbody> </table> <p>MACRO</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>If set, position data sent over MACRO network is shifted up 5 bits for compatibility with Delta-Tau controllers.</td> </tr> <tr> <td>1</td> <td>If set, drive will be disabled on startup until it is enabled through MACRO interface. If clear, drive can be used without</td> </tr> </tbody> </table>	Bits	Meaning	0	Must be clear to select CANopen networking.	1-2	Reserved.	3	If set, use an alternative method of assigning Node IDs to each axis. See Input Pin Mapping for Node ID Selection (0x103) for details	4-7	Reserved	8	If set, PDO mapping will be saved to flash when object 0x1010 is used to save drive state.	9	If set, PDO communications settings will be stored to flash when object 0x1010 is used to save drive state	10-15	Reserved	Bits	Meaning	0	Must be set to select DeviceNet networking.	1-15	Reserved.	Bits	Meaning	0	If set, position data sent over MACRO network is shifted up 5 bits for compatibility with Delta-Tau controllers.	1	If set, drive will be disabled on startup until it is enabled through MACRO interface. If clear, drive can be used without
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ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					MACRO interface connected until it starts receiving MACRO messages.
					2 If set, return primary encoder index state (high/low) in the home status bit of MACRO status word. If clear, state of any general-purpose input configured as home input will be used.
					3 If set, drive will attempt to synchronize its current loop update period to MACRO ring period. Ring period must be an integer multiple of drive's PWM Period (0x85) .
					4-7 Defines what type of additional data is transmitted in the first auxiliary data register of every MACRO response message: 0 – Send digital input value 1 – Send secondary analog reference value 2 – Send unfiltered secondary analog reference value 3 – Send motor encoder reading 4 – Send load encoder reading
					8-11 Defines what type of additional data is transmitted in second auxiliary data register of every MACRO response message: 0 – send analog input value 1 – send primary encoder reading 2 – send secondary encoder reading 3 – Pulse & direction hardware count. 4 – Unfiltered analog reference value
					12 If set, push synchronization point back ½ current loop period.
					13-15 Reserved.
					EtherCAT
					Bits Meaning
					0 If set, disable some extra checks of SYNC0 configuration which were added for improved network conformance.
					1 If set, drive will follow EtherCAT state machine even when running in a non EtherCAT mode of operation.
					2 If set, object 0x1002 is bit-wise OR of all axes Event Status Register (0xA0) for multi-axis drives. If clear, 0x1002 is for axis 1 only.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description										
					<table border="1"> <tr> <td>3</td> <td>If set, value of Network Node Id Configuration (0xC1) will be used as network alias on powerup. If clear, alias will be set from address switches</td> </tr> <tr> <td>4-7</td> <td>Reserved.</td> </tr> <tr> <td>8</td> <td>If set, PDO mapping will be saved to flash when parameters are saved using object 0x1010</td> </tr> <tr> <td>9</td> <td>If set, use UDP command mode rather than standard EtherCAT operation.</td> </tr> <tr> <td>10-15</td> <td>Reserved</td> </tr> </table>	3	If set, value of Network Node Id Configuration (0xC1) will be used as network alias on powerup. If clear, alias will be set from address switches	4-7	Reserved.	8	If set, PDO mapping will be saved to flash when parameters are saved using object 0x1010	9	If set, use UDP command mode rather than standard EtherCAT operation.	10-15	Reserved
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0x122	0x522	0x2384:26	F*	INT16	Internal Regen Current. Units : mA. Internal drive constant for factory use.										
0x123	0x523	0x2220	RF	INT32	Motor Encoder Wrap Position. Units: counts Actual motor position will wrap back to zero when this value is reached. Setting this value to zero disables this feature.										
0x124	0x524	0x2221	RF	INT32	Load Encoder Wrap Position. Units: counts Actual load position will wrap back to zero when this value is reached. Setting this value to zero disables this feature.										
0x125	0x525	None	RF	INT16	Configures MACRO drive's encoder capture circuit. This parameter is only used on MACRO drives. Bit-mapped as follows:										
				Bits	Meaning										
				0-3	Type of capture to use.										
					<table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Capture on edge of encoder index.</td> </tr> <tr> <td>1</td> <td>Capture using a general-purpose input pin.</td> </tr> <tr> <td>2-15</td> <td>Reserved.</td> </tr> </tbody> </table>	Value	Description	0	Capture on edge of encoder index.	1	Capture using a general-purpose input pin.	2-15	Reserved.		
Value	Description														
0	Capture on edge of encoder index.														
1	Capture using a general-purpose input pin.														
2-15	Reserved.														
				4-7	Input pin number to use if using capture type 1.										
				8	Active level; high if clear, low if set.										
				9	If set, capture is re-enabled immediately when the capture position is read (using I-variable 921). If clear, capture is only re-enabled on an explicit clear instruction.										
				10	If set, passive load encoder, if configured, will be captured. Passive load encoder currently only supports capture type 1 (general purpose input).										

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description		
					11-15 Reserved.		
0x126	0x526	0x2384:27	R*	INT16	FPGA Version Number.		
0x127	0x527	0x2370	RF	U32	Gain Scheduling Configuration:		
					Bits	Meaning	
					0-2	Key parameter for gain scheduling.	
						Value	Description
						0	None. Setting key parameter to zero disables gain scheduling.
						1	Use value written to Gain Schedule Key Parameter (0x128) as the key.
						2	Use Instantaneous Commanded Velocity (0x3B) .
						3	Use Load Encoder Velocity (0x5F) .
						4	Use Commanded Position (0x2D) .
						5	Use Actual Position (0x17) .
						6-7	Reserved.
							In addition to setting this parameter, a gain table must be loaded into the CVM file system. The table must be given the name '_GAINS' in CVM file system. When gain scheduling is active, drive will linearly interpret between rows of the table based on current value of key parameter. This table should contain at least two rows of gains. Each row must contain the following information:
						1	Key value. This is 32-bit value which must increase for each entry in table. Most significant word is stored first.
						2	Position loop proportional gain.
						3	Velocity loop proportional gain.
	4	Velocity loop integral gain					
	5	Current offset value					
	6	Position loop integral gain					
	7	Position loop derivative gain					
	3-7	Reserved.					
	8	If set, use absolute value of key parameter for gain lookup.					

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description																		
					<table border="1"> <tr> <td>9</td> <td>If set, disable gain scheduling until position encoder is referenced.</td> </tr> <tr> <td>10-15</td> <td>Reserved.</td> </tr> <tr> <td>16</td> <td>Table includes position loop PP if set.</td> </tr> <tr> <td>17</td> <td>Table includes velocity loop VP if set</td> </tr> <tr> <td>18</td> <td>Table includes velocity loop VI if set</td> </tr> <tr> <td>19</td> <td>Table includes current loop offset if set</td> </tr> <tr> <td>20</td> <td>Table includes position loop PI if set</td> </tr> <tr> <td>21</td> <td>Table includes position loop PD if set</td> </tr> <tr> <td>22-31</td> <td>Reserved.</td> </tr> </table>	9	If set, disable gain scheduling until position encoder is referenced.	10-15	Reserved.	16	Table includes position loop PP if set.	17	Table includes velocity loop VP if set	18	Table includes velocity loop VI if set	19	Table includes current loop offset if set	20	Table includes position loop PI if set	21	Table includes position loop PD if set	22-31	Reserved.
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22-31	Reserved.																						
0x128	0x528	0x2371	R	INT32	Gain Scheduling Key Parameter Value. When gain scheduling is enabled, current value of key parameter is stored here. When this parameter is selected as key parameter for gain scheduling, then it may be written to manually move through entries in gain scheduling table.																		
0x129	0x529	0x2384:29	R	U32	Drive Hardware Options. Reserved for Copley Controls use.																		
0x12A	0x52A	0x2222	F	U32	<p>Motor Encoder Options. Used to specify various configuration options for motor encoder. Mapping of option bits to function depends on encoder type. Any bit not defined for an encoder should be considered reserved. Reserved bits should be set to zero to ensure compatibility with future firmware updates. Bit-mapped as follows:</p> <table border="1"> <tr> <td colspan="2">Quadrature Encoder</td> </tr> <tr> <td>Bits</td> <td>Description</td> </tr> <tr> <td>0</td> <td>If set, ignore differential signal errors (if detected in hardware).</td> </tr> <tr> <td>1</td> <td>If set, select single ended encoder inputs (if available in hardware).</td> </tr> <tr> <td>2</td> <td>If set, ignore differential signal errors on index input only (if supported by hardware).</td> </tr> <tr> <td>3</td> <td>If set, don't use index input at all. Useful when index input is being used by a different encoder interface.</td> </tr> <tr> <td colspan="2">EnDat Encoder (Type 11)</td> </tr> <tr> <td>Bits</td> <td>Description</td> </tr> <tr> <td>0-5</td> <td>Number of bits of single turn data available from encoder.</td> </tr> </table>	Quadrature Encoder		Bits	Description	0	If set, ignore differential signal errors (if detected in hardware).	1	If set, select single ended encoder inputs (if available in hardware).	2	If set, ignore differential signal errors on index input only (if supported by hardware).	3	If set, don't use index input at all. Useful when index input is being used by a different encoder interface.	EnDat Encoder (Type 11)		Bits	Description	0-5	Number of bits of single turn data available from encoder.
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ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
					8-12	Number of bits of multi-turn data available from encoder.
					16	If set, analog inputs are supplied by encoder.
					17	If set, use multi-mode port.
					18	If set, read position using EnDat 2.2 style commands rather than default 2.1 style.
					19	If set, read encoder at current loop update rate. Otherwise, encoder is read at servo loop period.
					20-23	Number of least significant bits of encoder reading to discard.
					SSI Encoder (Type 12)	
					Bits	Description
					0-5	Number of bits of position data available.
					8-11	Number of extra bits sent with position data.
					12	*If set, ignore first bit of data sent by encoder.
					13	If set, encoder outputs position data using Gray code.
					14	*If set, pull clock low briefly after data (custom for Codechamp encoder).
					15	If set, data is sent least signification bit first.
					16-21	Encoder Bit Rate. If set, use 100 kHz units. If zero, use default 1 MHz units.
					22	*If set, use setting of Motor Encoder Counts/Rev (0x62) to determine how many data bits to use.
					23	If set, extra status bits are before position data. If clear, extra status bits are after position data. Default is clear.
					24	If set, first bit sent is 'data valid' bit.
					25	If set, use multi-mode port for SSI interface.
					26	If set, extra bits after position data are treated as fault bits and generate an encoder fault if any are set.
					* NOTE – these three bits are depreciated and will be removed in future firmware versions.	

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description																												
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20	If set, encoder error and warning bits are active low																																
21	Set if encoder status bits are sent before position data, clear if status bits are sent after position data																																
22	If set, encoder error bit is transmitted before warning bit. If clear, warning bit sent first.																																
23	If set, error bits are sent after alignment bits. If clear, encoder error bits are sent between alignment bits and position data.																																
24-27	Number of alignment bits (reserved bits sent before position info).																																
28	If set, use multi-mode encoder. If clear, use primary encoder.																																
30	If set, use 2.5 MHz baud rate. If clear, use 4 MHz baud rate.																																
					<p>BiSS encoders are not always consistent with order in which data is sent. We treat data as consisting of three fields, position data <P>, 2 status bits <S> and optional alignment bits <A> which we ignore. Formatting bits identify order of these three fields. Chart below shows order of fields based on format code. Note that data is always sent most significant bit first, so leftmost field is first transmitted.</p> <p>Format Order of fields</p> <p>0 <P> <S> <A> 1 <S> <P> <A> 2 <P> <A> <S> 3 <S> <A> <P></p>																												
					Tamagawa, Panasonic, Harmonic Drives, etc. (Type 14)																												
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ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					8-12 Number of bits of multi-turn data.
					16-19 Number of LSB to discard from reading.
					20-22 Number of consecutive CRC errors to ignore before generating an error.
					24-27 Encoder sub-type (0=Tamagawa, 1=Panasonic absolute, 2=HD systems, 3=Panasonic Incremental, 4=Sanyo Denki, 5=Tamagawa Single Turn).
					28 Bit rate (set for 4 Mbit, clear for 2.5 Mbit).
					30 If set, treat encoder battery errors as warnings.
					31 Read the encoder's internal temperature sensor. Currently only for Sanyo Denki encoders. Temperature value read from encoder can be read as encoder register 0.
					Incremental Type E (Type 15)
					Bit Description
					0 If set, incremental encoder. If clear, absolute encoder.
					8 If set, disable interpolation of position
					Gurley Virtual Absolute (Type 17)
					0 If set, invert sine/cosine signals
					1 If set, invert virtual absolute signal
					2 If set, use custom interface board (customer specific).
					3 If set, use encoder digital index input for VABS. If clear, use encoder analog index (if available).
					8 If set, switch from algorithmic phase initialization to encoder-based phasing as soon as absolute position is found
					9 If set, treat any VABS warnings as encoder fault. If clear, these warnings set status bits but aren't treated as encoder errors.
					Custom Absolute Encoder (Type 18)
					Bit Description
					28 If set, use multimode input. If clear, use primary encoder input.
					S2 Custom Encoder (Type 19)
					Bit Description
					0-4 Number of bits of single turn position data / rev.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					8 Set for incremental encoders, clear for absolute
					9 Use multimode port if set. If clear use primary encoder interface
					10 If set, treat encoder battery errors as warnings.
					Wire saving incremental (type 21):
					Bit Description
					0-15 These bits are the same as a normal incremental encoder (type 0).
					16 If set, reverse direction of simulated hall signals after powerup
					17 If set, sample halls 10ms after they stabilize on power-up. If clear, sample them after 100ms.
					18 If set, force the simulated hall signals to transition coincident with the index signal.
					Sankyo Absolute Encoder (Type 22):
					Bit Description
					0 Ignore battery errors if set
					1-31 Reserved
					Custom Absolute Encoder M (Type 23)
					Bit Description
					0 Use the multimode port if set
					1 Ignore battery errors
0x12B	0x52B	0x2223	F	U32	Load Encoder Options. Same details as Motor Encoder Options (0x12A) but affects load or position encoder.
0x12C	0x52C	0x2384:28	R*	U32	Nios Processor Firmware Version Number. Only used on three-axis drive for now.
0x12D	0x52D	0x2109	RF	9 or 14	Analog Input Filter Coefficients. A biquad filter which acts on the analog reference input. 9- or 14-word parameters, see <i>Analog Input Filters</i> in <i>CME 2 User Guide</i> . 14-word parameter (Plus and AFS products only), see Filter Coefficients .
0x12E	0x52E	0x2224	R*	U32	Motor Encoder Status. This parameter gives additional status information for encoder. Bits set in status word are latched and cleared when status value is read. Format of this status word is dependent on encoder type. Many error bits are taken directly from encoder data stream. For full description of what these error bits mean, please consult encoder manufacturer.
					Quadrature
					Bits Description

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					0 Only used for custom incremental encoders. Set on startup if encoder did not transmit hall information successfully.
					1 Set on bad differential signal levels on any of encoder inputs.
					EnDAT (Type 11)
					Bits Description
					0 CRC error on data received from encoder.
					1 Failed to detect encoder connected to drive.
					2 Error bit on encoder stream is active.
					3 Encoder failed to respond to request for position.
					SSI (Type 12)
					Bits Description
					0-6 Fault flags returned from encoder.
					15 Encoder data invalid bit set.
					BiSS (Type 13)
					Bits Description
					0 CRC error on data received from encoder.
					1 Encoder failed to transmit data to drive.
					2 Error bit on encoder stream is active.
					3 Warning bit on encoder stream is active.
					4 Encoder transmission delay is too long.
					Tamagawa & Panasonic (Type 14)
					Bits Description
					0 Over speed error reported by encoder.
					1 Absolute position error reported by encoder.
					2 Counting error reported by encoder.
					3 Counter overflow reported by encoder.
					5 Multi-turn error reported by encoder.
					6 Battery error reported by encoder.
					7 Battery warning reported by encoder.
					8 Error bit 0 reported by encoder.
					9 Error bit 1 reported by encoder.
					10 Comm error 0.
					11 Comm error 1.
					15 CRC error on data received from encoder.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description																						
					Sanyo Denki & Harmonic Drives (Type 14)																						
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ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					2 INPALM bit from encoder set
					8 CRC error on data received from encoder
					S2 Custom Encoder (Type 19)
					Bit Description
					0 Battery error alarm bit from encoder
					1 Encoder error alarm bit from encoder
					2 Battery warning alarm bit from encoder
					3 Absolute error alarm bit from encoder
					4 Over speed error alarm bit from encoder
					5 Over heat error alarm bit from encoder
					8 CRC error on data received from encoder
					9 Encoder not responding to queries from drive.
					Sankyo Absolute Encoder (Type 22)
					Bit Description
					0 Set if encoder is not responding to commands
					1 Set if error bit is returned by encoder
					2 Set if encoder returns incorrectly formatted data
					3-7 Reserved
					8 Encoder reports "MR sensor amplitude error"
					9 Encoder reports "Multi rotation data error"
					10 Encoder reports "battery error"
					11 Encoder returned reserved error bit
					12 Encoder reports "MR sensor error"
					13 Encoder reports "Over speed error"
					14 Encoder reports "Temperature error"
					15 Encoder returned reserved error bit
					Custom Absolute Encoder M (Type 23)
					Bit Description
					0 Encoder reported 'CPU alarm'
					1 Encoder reported reserved alarm bitmapped
					2 Encoder reported 'Data alarm'
					3 Encoder reported 'Thermal alarm'

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0x12F	0x52F	0x2225	R*	U32	Load Encoder Status. Same details as Motor Encoder Status (0x12E) , but for load encoder.																
0x130	0x530	0x2114	RF	INT16	RMS Current Calculation Period. Units: ms. This sets period over which RMS current is calculated. If this value is set to zero, then RMS current will be updated each time it is read for period since the last read. In this case, RMS current must be read at least once every 65536 current loop periods (about every 4 seconds) for returned RMS values to be accurate.																
0x131	0x531	0x2115	R*	INT16	RMS Current over period set in RMS Current Calculation Period (0x130) . Units: 0.01 A.																
0x132	0x532	0x2116	R*	INT16	Running Sum of User Current Limit. Units: 0.01%. Values will be 0 to 10000.																
0x133	0x533	0x2117	R*	INT16	Running Sum of Drive Current Limit. Units: 0.01% Values will be 0 to 10000.																
0x134	0x534	0x21E0	RF	U32	<p>Analog Output D/A converter configuration. This parameter sets mode for D/A converter on drives so equipped.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-3</td> <td>Defines mode of D/A converter</td> </tr> <tr> <td>16</td> <td>If set, current outputs will be scaled based on motor peak current setting rather than drive's internal scaling.</td> </tr> </tbody> </table> <p>Currently supported modes are:</p> <table border="1"> <thead> <tr> <th>Mode</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Manual configuration. Set using Analog Output D/A (0x135)</td> </tr> <tr> <td>1</td> <td>Actual Current of configured axis. If bit 16 is clear, then output voltage is scaled so that full 5V output on D/A will correspond to Current Corresponding to Max A/D Reading (0x84). If bit 16 is set, then voltage is scaled based on motor peak current setting</td> </tr> </tbody> </table>	Bits	Description	0-3	Defines mode of D/A converter	16	If set, current outputs will be scaled based on motor peak current setting rather than drive's internal scaling.	Mode	Description	0	Manual configuration. Set using Analog Output D/A (0x135)	1	Actual Current of configured axis. If bit 16 is clear, then output voltage is scaled so that full 5V output on D/A will correspond to Current Corresponding to Max A/D Reading (0x84) . If bit 16 is set, then voltage is scaled based on motor peak current setting				
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					<table border="1"> <tr> <td>2</td> <td>Actual Velocity of configured axis, ratio of actual velocity to Velocity Loop Velocity Limit (0x3A).</td> </tr> <tr> <td>3</td> <td>U winding current, scaled same as mode 1.</td> </tr> <tr> <td>4</td> <td>V winding current, scaled same as mode 1.</td> </tr> <tr> <td>5</td> <td>W winding estimated current, scaled same as mode 1.</td> </tr> </table>	2	Actual Velocity of configured axis, ratio of actual velocity to Velocity Loop Velocity Limit (0x3A) .	3	U winding current, scaled same as mode 1.	4	V winding current, scaled same as mode 1.	5	W winding estimated current, scaled same as mode 1.
2	Actual Velocity of configured axis, ratio of actual velocity to Velocity Loop Velocity Limit (0x3A) .												
3	U winding current, scaled same as mode 1.												
4	V winding current, scaled same as mode 1.												
5	W winding estimated current, scaled same as mode 1.												
0x135	0x535	0x21E1	R	INT16	Analog Output D/A Converter Output Value. Units: mV. For drives that support auxiliary D/A converter, this sets output value when D/A is in manual mode. In other modes, current value being output on D/A can be read here.								
0x136	0x536	0x2208	R*	INT16	Second Analog Input. Units: mV. Also known as Secondary analog reference value.								
0x137	0x537	0x2314	RF	INT16	Offset for secondary analog reference input. Units: mV.								
0x138	0x538	0x2315	RF	INT16	Calibration offset, second analog input. Units: mV. Factory-calibrated to give zero reading for zero input voltage.								
0x139	0x539	0x219D	R	INT32	<p>Drive Safety Circuit Status. This parameter allows status of safety circuit built into some drives to be queried. For drives without safety circuit, this parameter is reserved.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Set when safety input 0 is preventing drive from enabling.</td> </tr> <tr> <td>1</td> <td>Set when safety input 1 is preventing drive from enabling.</td> </tr> <tr> <td>8</td> <td>This read/write bit can be used to force 'drive is unsafe' output of safety circuit to go active for testing purposes. Write 1 to force this output active. Write zero for normal operation.</td> </tr> </tbody> </table>	Bits	Description	0	Set when safety input 0 is preventing drive from enabling.	1	Set when safety input 1 is preventing drive from enabling.	8	This read/write bit can be used to force 'drive is unsafe' output of safety circuit to go active for testing purposes. Write 1 to force this output active. Write zero for normal operation.
Bits	Description												
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1	Set when safety input 1 is preventing drive from enabling.												
8	This read/write bit can be used to force 'drive is unsafe' output of safety circuit to go active for testing purposes. Write 1 to force this output active. Write zero for normal operation.												
0x13A	0x53A	0x2209	R*	INT16	Present Voltage at Analog Motor Temperature Sensor. Units: mV. If thermistor characteristics have been programmed in Steinhart Contants (0x19A) , then temperature is returned in degrees C. Note that this parameter is only valid for drives that include an analog temperature sensor input.								
0x13B	0x53B	0x220A	RF	INT16	Limit for Analog Motor Temperature Sensor. Units: mV. If this parameter is set to zero, then analog motor temperature sensor is disabled.								

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
					<p>If this parameter is set to positive value, then motor temperature error will occur any time voltage on motor temperature input exceeds this value.</p> <p>If this parameter is set to negative value, then motor temperature error will occur any time voltage on the motor temperature input is lower than absolute value of this limit.</p> <p>If thermistor characteristics have been programmed in Steinhart Constants (0x19A), then this gives maximum motor temperature in degrees C.</p>	
0x13C	0x53C	0x2323	RF	INT16	<p>Minimum PWM Pulse Width. Units: ms. Used when running in PWM position mode. In this mode PWM input pulse width is captured by drive and used to calculate an absolute position using following formula: $\text{pos} = ((\text{PW-MIN}) / (\text{MAX-MIN})) * \text{SCALE} + \text{OFFSET}$ where this parameter is minimum pulse width (MIN), <i>parameter 0x13D</i> is maximum pulse width (MAX), <i>parameter 0xA9</i> is scaling factor (SCALE) and <i>parameter 0x10F</i> is offset (OFFSET).</p>	
0x13D	0x53D	0x2324	RF	INT16	<p>Maximum PWM Pulse Width. Units: us. Used only when running in PWM position mode.</p>	
0x13E	0x53E	0x222A	RF	U32	Encoder Adjustment Table Configuration. See applications note for additional details.	
					Bit	Description
					0	Set to enable encoder adjustment table
					1	If set, use resolver angle adjustment tables. If clear, use normal encoder adjustment tables
2	Set for cogging compensation mode (see applications note for details)					
0x13F	0x53F	0x232B	RF	INT16	<p>PWM Input Deadband. Range of 0 to 32767 equals deadband of 0 to 100%.</p>	
0x141	0x541	0x2243	R	INT16	<p>Resolver angle scaled so 180 deg is 32767. Only valid when using resolver as motor encoder feedback. Reserved for other encoder types.</p>	
0x150	0x550	0x210A	RF	14	<p>Second chained biquad filter on output of velocity loop. 14-word parameter, see Filter Coefficients.</p>	
0x151	0x551	0x210B	RF	14	<p>Third chained biquad filter on output of velocity loop. 14-word parameter, see Filter Coefficients.</p>	
0x152	0x552	0x210C	RF	14	<p>First chained biquad filter on input of current loop. 14-word parameter, see Filter Coefficients.</p>	
0x153	0x553	0x210D	RF	14	<p>Second chained biquad filter on input of current loop. 14-word parameter, see Filter Coefficients.</p>	

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0x154	0x554	0x2301	RF	INT32	Servo Loop Configuration. This parameter allows various parts of drive servo loops to be enabled/disabled. Bit-mapped as follows:	
					Bit	Description
					0	If set, this disables Velocity loop gains. Velocity Feed Forward (0x157) is still active as are velocity loop output filters.
					1	If set, this enables <i>Position Loop I (0x155)</i> and <i>Position Loop D (0x156)</i> gains. If clear, these are treated as zeros.
					2	If set, velocity error windows will be calculated using filtered version of the motor velocity. If clear, unfiltered velocity will be used.
					8	If set, initialize velocity loop integral sum when switching modes to prevent glitches on output current
Other	Reserved					
0x155	0x555	0x2382:5	RF	INT16	Integral Gain, Position Loop (PI).	
0x156	0x556	0x2382:6	RF	INT16	Derivative Gain, Position Loop (PD).	
0x157	0x557	0x2381:6	RF	INT16	Velocity Loop Command Feed Forward (Vcff). Input command (after limiting) to velocity loop is scaled by this value and added into output of velocity loop.	
0x158	0x558	0x2382:7	RF	INT16	Integral Drain, Position Loop (Pi Drain).	
0x159	0x559	0x6007	RF	INT16	Abort Option Code, CANopen/EtherCAT drives.	
0x15A	0x55A	0x2198	RF	U32	I/O Options. This parameter is used to configure optional features of general purpose I/O.	
					Bits	Description
					0-3	For Plus Module drives, these bits determine whether several I/O pins are used as serial interface for expanded I/O features, and if so how they are configured.
						0
					1	Plus Module drive development board LEDs and address switches
					4-7	Reserved
8	For Plus module drives, setting this bit allows the STO LED to be illuminated even if the drive is disabled by firmware if the STO inputs are connected					
9-15	Reserved					

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description								
					16 On AC powered Plus drives, this bit disables AC line drop detection if set								
					17-31 Reserved								
0x15B	0x55B	0x2199	F	INT16	Motor Brake Enable Delay Time. Units: ms. This parameter gives delay between enabling drive PWM outputs and releasing brake. Positive values mean PWM is enabled first and brake is released N ms later. Negative values cause brake to be released before PWM outputs are enabled.								
0x15C	0x55C	0x219A	R*	U32	Input Pin States, 32-bit. 32-bit version of Input Pin States (0xA6) . Each bit gives high/low state of one general purpose input pin. Lower 16 bits of this parameter are equivalent to value returned by Input Pin States (0xA6) . This parameter is primarily used for drives with more than 16 general purpose input pins.								
0x15D	0x55D	0x219B	R*	U32	Raw Input State, 32-bit. 32-bit version of Raw Input State (0xAA) . Gives current high/low state of all general-purpose inputs before any debounce is applied.								
0x15E	0x55E	0x219C	RF	U32	Input Pin Configuration, 32-bit. 32-bit version of Input Pin Configuration (0xA5) . Used to configure pull up/down resistors on drives with more than 16 such resistors.								
0x15F	0x55F	0x237B	RF	U32	Motor Cogging Compensation. This was added to Plus drives starting with version 3.18 firmware. Scales current command to motor based on sine of phase angle plus programmable offset. Bit-mapped as follows:								
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0x160	0x560	0x2192:17	RF	U16	Input Pin Configuration, General Purpose Input 17. See Input 0 Configuration (0x78) . For notes on Input numbering, see Input/Output Numbering .								
0x161	0x561	0x2192:18	RF	U16	Input Pin Configuration, General Purpose Input 18. See Input 0 Configuration (0x78)								
0x162	0x562	0x2192:19	RF	U16	Input Pin Configuration, General Purpose Input 19. See Input 0 Configuration (0x78)								

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description																										
0x163	0x563	0x2192:20	RF	U16	Input Pin Configuration, General Purpose Input 20. See Input 0 Configuration (0x78)																										
0x164	0x564	0x2192:21	RF	U16	Input Pin Configuration, General Purpose Input 21. See Input 0 Configuration (0x78)																										
0x165	0x565	0x2192:22	RF	U16	Input Pin Configuration, General Purpose Input 22. See Input 0 Configuration (0x78)																										
0x166	0x566	0x2192:23	RF	U16	Input Pin Configuration, General Purpose Input 23. See Input 0 Configuration (0x78)																										
0x167	0x567	0x2192:24	RF	U16	Input Pin Configuration, General Purpose Input 24. See Input 0 Configuration (0x78)																										
0x170	0x570	0x2195:17	RF	U16	Debounce Time, General Purpose Input 17. Units: ms.																										
0x171	0x571	0x2195:18	RF	U16	Debounce Time, General Purpose Input 18. Units: ms.																										
0x172	0x572	0x2195:19	RF	U16	Debounce Time, General Purpose Input 19. Units: ms.																										
0x173	0x573	0x2195:20	RF	U16	Debounce Time, General Purpose Input 20. Units: ms.																										
0x174	0x574	0x2195:21	RF	U16	Debounce Time, General Purpose Input 21. Units: ms.																										
0x175	0x575	0x2195:22	RF	U16	Debounce Time, General Purpose Input 22. Units: ms.																										
0x176	0x576	0x2195:23	RF	U16	Debounce Time, General Purpose Input 23. Units: ms.																										
0x177	0x577	0x2195:24	RF	U16	Debounce Time, General Purpose Input 24. Units: ms.																										
0x180	0x580	0x2326	RF	U32	UV configuration. Used to configure drive when running in UV mode, Desired State (0x24) , Mode 5. Bit-mapped as follows (undocumented bits reserved for future use):																										
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ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					10-15 Reserved.
					16 If set, value of Motor Hall Offset (0x4F) is added to UV angle
					17 If set, drive will use field oriented control. Normally FOC is disabled in UV mode due to ambiguity of phase angle with zero inputs. This is best used when running in angle/magnitude format.
0x181	0x581	0x2327	R	INT16	U Input when running in UV mode. This parameter can be used to read calculated U value or to set U value when UV inputs are being directly set over serial/network interface.
0x182	0x582	0x2328	R	INT16	V Input when running in UV mode. Same as 0x181 but for V Input.
0x183	0x583	0x2329	R	INT16	Raw Counter Value From Pulse & Direction Input. This can be read when running in any mode, not just pulse & direction modes. This parameter can be written also, but should not be written when drive is being controlled by pulse & direction inputs. Writing in that mode will cause drive to treat change in counter as real pulse inputs resulting in possible unexpected motion.
0x184	0x584	0x2254	RF	8 to 40	Input Shaping Filter. This filter is used to modify trajectory before it is input into position loop. This can be used to compensate for low frequency resonances in loads. Parameter is an array of 32-bit values. First four values are used to store information about input shaping filter (filter type, frequency, etc.) and are mostly unused by firmware. The only exception is that most significant bit of first word should not be set to ensure compatibility with future firmware versions. The remaining 32-bit values are pairs of IEEE floating point values. Each pair defines a time (first value) and an impulse amplitude (second value). Up to eight pairs may be passed for up to 8 impulses in input shaping filter. Time values are specified in seconds and must be ≥ 0.0 . Impulse values are unit-less and must have an absolute magnitude of < 16.0 .
0x185	0x585	0x2160	R	U32	Output Compare Configuration. For detailed description of output compare function, see Trigger Outputs at Position application note describing it.
0x186	0x586	0x2161	R	U32	Output Compare Status.
0x187	0x587	0x2162	R	INT32	Output Compare Value 1.
0x188	0x588	0x2163	R	INT32	Output Compare Value 2.
0x189	0x589	0x2164	R	INT32	Output Compare Increment.
0x18A	0x58A	0x2165	R	INT32	Output Compare Pulse Width.

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description																										
0x18B	0x58B	0x2255	RF	INT32	<p>Trajectory options. This parameter is used to modify behavior of some trajectory modes. Interpretation depends on trajectory mode being used. Following trajectory modes currently make use of this parameter:</p> <p>EtherCAT CSP mode:</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-7</td> <td>Number of extra loop cycles to extrapolate trajectories if input data from master is not received.</td> </tr> <tr> <td>8-15</td> <td>Reserved.</td> </tr> <tr> <td>16</td> <td>If set, jump to quick stop mode if master data is not received within number of cycles set in bits 0-7.</td> </tr> <tr> <td>17</td> <td>If set, and <i>Interpolation Time object (0x60C2)</i> is non-zero, then calculated velocity will be filtered, and trajectory acceleration will also be calculated. If clear, velocity is unfiltered, and acceleration is not calculated (zero).</td> </tr> <tr> <td>18-31</td> <td>Reserved.</td> </tr> </tbody> </table>	Bits	Description	0-7	Number of extra loop cycles to extrapolate trajectories if input data from master is not received.	8-15	Reserved.	16	If set, jump to quick stop mode if master data is not received within number of cycles set in bits 0-7.	17	If set, and <i>Interpolation Time object (0x60C2)</i> is non-zero, then calculated velocity will be filtered, and trajectory acceleration will also be calculated. If clear, velocity is unfiltered, and acceleration is not calculated (zero).	18-31	Reserved.														
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0x18C	0x58C	0x21A1	RF	U32	<p>I/O Extension Configuration for Plus Modules. This parameter is used to configure I/O extension feature on Plus Modules which support it. For detailed description of this I/O extension feature, see Extending Plus Module I/O application note.</p> <table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0-7</td> <td>Number of bits to transfer less 1 (e.g., set to 19 to transfer 20 bits).</td> </tr> <tr> <td>8</td> <td>Reserved</td> </tr> <tr> <td>9</td> <td>If set, automatically restart transmission.</td> </tr> <tr> <td>10</td> <td>If set, leave CS line low after transfer.</td> </tr> <tr> <td>11</td> <td>Status bit indicating new receive data is available. Auto-cleared when data is read via parameter 0x18E</td> </tr> <tr> <td>12</td> <td>Clock polarity setting.</td> </tr> <tr> <td>13</td> <td>Data phase setting.</td> </tr> <tr> <td>14-15</td> <td>Reserved.</td> </tr> <tr> <td>16-23</td> <td>Clock period. Units: 100 ns.</td> </tr> <tr> <td>24-27</td> <td>Reserved.</td> </tr> <tr> <td>28</td> <td>If set, enable SPI I/O extension feature. If clear, enable LED/Switch interface</td> </tr> <tr> <td>29-31</td> <td>Reserved</td> </tr> </tbody> </table>	Bits	Description	0-7	Number of bits to transfer less 1 (e.g., set to 19 to transfer 20 bits).	8	Reserved	9	If set, automatically restart transmission.	10	If set, leave CS line low after transfer.	11	Status bit indicating new receive data is available. Auto-cleared when data is read via parameter 0x18E	12	Clock polarity setting.	13	Data phase setting.	14-15	Reserved.	16-23	Clock period. Units: 100 ns.	24-27	Reserved.	28	If set, enable SPI I/O extension feature. If clear, enable LED/Switch interface	29-31	Reserved
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0x18D	0x58D	0x21A2	R	INT32*	<p>I/O Extension Transmit Data. Data to be transferred over SPI port is sent immediately after being written here.</p> <p>*Data size is variable dependent on drive configuration. Refer to Extending Plus Module I/O application note.</p>																										

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
0x18E	0x58E	0x21A3	R	INT32*	I/O Extension Receive Data. Data received from SPI port can be read here. *Data size is variable dependent on drive configuration. Refer to Extending Plus Module I/O application note .
0x18F	0x58F	0x220B	RF	INT16	Encoder Sine Offset. This is set in A/D units and only used with resolvers and servo-tube motors. It gives an offset which is added to encoder sine signal before calculating position.
0x190	0x590	0x220C	RF	INT16	Encoder Cosine Offset. Like 0x18F, but for encoder cosine signal.
0x191	0x591	0x220D	RF	U16	Encoder Cosine Scaling Factor. Used by resolver & Servotube encoder calculations. This scaling factor is used to adjust cosine signal amplitude so it is same as sine signal amplitude. If set to zero, both Encoder Sine Offset (0x18F) and Encoder Cosine Offset (0x190) will be ignored. If non-zero the cosine is scaled by N/32768 where N is the value of this parameter.
0x192	0x592	0x2226	RF	U32	Motor Encoder Calibration settings. The meaning of this value is dependent on encoder type.
0x193	0x593	0x2227	RF	U32	Load Encoder Calibration settings. Same as 0x192, but applied to load encoder.
0x194	0x594	0x232A	R*	INT16	PWM Input Duty Cycle. This can be used to read duty cycle of PWM input. Returned 16-bit value gives duty cycle in range +/-32767. Digital Input Command Configuration (0xA8) is used to configure PWM input.
0x195	0x595	0x2123	RF	INT32	Jerk Value. Units: 100 counts/s ³ . Value to use during trajectory aborts. If this is zero, abort will be calculated without any jerk limits.
0x196	0x596	0x220E	R*	INT32	Returns magnitude squared of analog encoder signals ($\sin^2 + \cos^2$)
0x197	0x597	0x2378	RF	INT16	Cross Coupling X _{Pp} Gain. On dual axis drives this gain is applied to difference in position error of two axes.
0x198	0x598	0x2379	RF	INT16	Cross Coupling X _{Pi} Gain.
0x199	0x599	0x237A	RF	INT16	Cross Coupling X _{Pd} Gain.
0x19A	0x59A	0x220F	RF	5 words	Steinhart Constants, Motor Analog Temperature Sensor. This parameter is only used on drives that include motor temperature sensor analog input. For such drives, this parameter can be used to define type of NTC thermistor connected to analog input. If nonzero, motor temperature (in degrees C) will be read from Present Voltage at Analog Motor Temperature (0x13A) rather than analog voltage. Parameter uses same format as an output pin configuration, 16-bit integer followed by two 32-bit

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description
					integers. Three integer values contain A, B and C Steinhart- Hart coefficients for motor thermistor. Three coefficients are scaled by following constants: A: 1.0e6 B : 1.0e7 C: 1.0e10 For example, A thermistor with coefficients 1.4626e3, 2.4024e4 and 8.0353e8 would be configured with the three integer values: 1463, 2402 and 804.
0x19B	0x59B	0x2384:30	F*	INT16	Current at which minimum PWM deadtime is used.
0x19C	0x59C	0x2406	R*	INT32	High Speed Capture, Passive Load Encoder.
0x19D	0x59D	0x2142	RF	INT16	Open Motor Wiring Check Current. If Motor Brake Enable Delay Time (0x15B) is greater than zero, then during that time period on enable this current will be applied to motor wiring to check that motor is connected. If programmed current cannot be applied to motor, then motor disconnected fault will be flagged.
0x19E	0x59E	0x6066	RF	U16	Tracking Window Warning Time. Units: ms.
0x19F	0x59F	0x2264	RF	INT16	Phase Advance. Scaled so 32767 is 180 degrees.
0x1A0	0x5A0	0x2193:9	RF	3-5	Output 9 Configuration. See Output 0 Configuraton (0x70) .
0x1A1	0x5A1	0x2193:10	RF	3-5	Output 10 Configuration. See Output 0 Configuraton (0x70) .
0x1A2	0x5A2	0x2193:11	RF	3-5	Output 11 Configuration. See Output 0 Configuraton (0x70) .
0x1A3	0x5A3	0x2193:12	RF	3-5	Output 12 Configuration. See Output 0 Configuraton (0x70) .
0x1A8	0x5A8	0x2228	RF	INT16	Motor Encoder Downshift. This parameter is useful when using very high resolution encoders that would otherwise have limited speed and travel distance due to range of position and velocity parameters. Setting downshift causes position read from encoder to be right-shifted before being used. For example, setting this parameter to value of 2 effectively cuts the encoder resolution by a factor of 4. If set, servo loops use fractional encoder counts, therefore encoder resolution is not completely lost.
0x1A9	0x5A9	0x2229	RF	INT16	Load Encoder Downshift. Same as Motor Encoder Downshift (0x1A8) , but for load encoder.
0x1AA	0x5AA	0x21E2	RF	INT16	Fan Turn On Temperature. Units: Degrees C. For products with software controlled internal fan, this value is temperature when fan will first turn on.
0x1AB	0x5AB	0x21E3	RF	INT16	Fan Max Speed Temperature. Units: Degrees C. For products with software controlled internal fan, this value is temperature when fan will run at top speed. Must be >= Fan Turn On Temperature (0x1AA) or value will be ignored

ASCII	MACRO	CAN/ECAT IDX: SUB	Mem	Type	Description	
0x1AD	0x5AD	0x21E4	RF	INT16	Encoder Cosine Angular Offset. Units: 0.1 degree This parameter gives angular error of encoder cosine signal. Used to compensate for imperfections in encoder signals. This adjustment is only used if Encoder Cosine Scaling Factor (0x191) is nonzero.	
0x1AE	0x5AE	0x21A4	RF	U32	Inter-drive communication configuration. This parameter is only used on drives that support the IDC bus.	
					Bit	Description
					0	Set for IDC master. Clear for IDC slave devices
					1	Set to disable serial command forwarding via IDC
8-10	Address of partner axis for cross coupling					
0x1AF	0x5AF	0x21A5	R	U32	Inter-drive communication status.	
					Bit	Description
					0	Synchronized to IDC bus if set
					1	Address assignment complete if set
					2	IDC running normally if set
					8	Set if IDC is reset
16-18	Assigned IDC address					

4 FILTER COEFFICIENTS

There are several drive parameters which are used to define filters. These filters are implemented as generic biquadratic filter structures. Filters of this type implement the following formula to transform the input parameter $x(n)$ at time n to an output parameter $y(n)$:

$$y(n) = b_0 \cdot x(n) + b_1 \cdot x(n-1) + b_2 \cdot x(n-2) + a_1 \cdot y(n-1) + a_2 \cdot y(n-2)$$

Values a_1 , a_2 , b_0 , b_1 , b_2 are constants known as filter coefficients. They define the type of filter being implemented.

Values passed to these drive filter parameters are used to define filter coefficients. Formatting of these parameters varies depending on drive family being interfaced to.

All first-generation Copley drives use 16-bit integer math to implement their filters internally. Filter coefficients are given as 16-bit signed integer values. To increase resolution of these coefficients, an additional unsigned scaling coefficient (k) is also specified. Actual filter formula used within these drives is as follows:

$$y(n) = K \cdot (b_0 \cdot x(n) + b_1 \cdot x(n-1) + b_2 \cdot x(n-2) + a_1 \cdot y(n-1) + a_2 \cdot y(n-2)) / 32768 / 4096$$

To set filter coefficients on drives of this category, 9 words of parameter data are passed. First three words of data are informational parameters which are used by CME software to describe filter. If upper 3 bits of first word are all set, then filter will be disabled. Other than that, first three words of data are not used in any way by firmware. These three words are reserved for CME use.

Word	Description
1	Filter info. Set to 0xFFFF to disable filter. Otherwise, reserved for CME use.
2	Filter info. Reserved for CME use.
3	Filter info. Reserved for CME use.
4	b_2 coefficient.
5	b_1 coefficient.
6	b_0 coefficient.
7	a_2 coefficient.
8	a_1 coefficient.
9	K scaler.

For Plus family of drives (Accelnet Plus, Stepnet Plus, Xenus Plus), a new format is used to describe Biquad filter coefficients. These drives include ability to design filters in firmware using Cephes filter design library.

Filters on these families of drives are calculated internally using 32-bit IEEE floating point coefficients. Format of parameter information passed when setting filter parameters on these drives consists of an array of up to fourteen 16-bit words. First 4 words describe filter and remaining 10 words give filter coefficients as 32-bit IEEE floating point values. Filter coefficient words are optional and are only necessary if firmware is not calculating coefficients internally.

Parameter Dictionary

Word	Description	
1	Bits	Usage
	0-3	Filter family.
	4	If set, filter will not be designed. Always set by firmware after successfully designing filter. This prevents filter from being redesigned when copied from flash at startup.
	5-7	Reserved.
	8	Number of poles - 1 (i.e. 0 for single pole, 1 for two pole).
	9-12	Reserved.
	13-15	Filter type.
	All reserved bits should be set to zero. Filter family should be one of following values:	
	0	Custom Bi-quad filter. Coefficients must be passed; firmware will not design filter.
	1	Butterworth filter.
	2	Chebychev filter.
	3	Elliptic filter.
	4-15	Reserved.
	Filter type should be one of the following:	
	0	Custom Bi-quad filter. Coefficients must be passed; firmware will not design filter.
	1	Low pass.
	2	High pass.
	3	Band reject (notch).
	4	Band pass.
	5-6	Reserved
7	Disabled. The filter will have no effect in system.	
If legal values are passed for filter type and family, firmware will attempt to design specified filter and fill in coefficient values itself. Firmware can calculate 1- or 2-pole low pass or high pass filters. For notch and band pass filters firmware can only calculate 2-pole filter. For these filter types, bit 8 must be set.		
2	This word gives cut off frequency for low pass and high pass filters. Units: Hz. For notch and band pass filters this gives first filter frequency.	
3	This word gives second filter frequency for notch and band pass filters. Units: Hz.	
4	Bits	Usage
	0-7	Rp. Units: 0.1 dB.
	8-15	Rs. Units: dB.
Rp is pass band ripple. This parameter is only used for Chebychev and Elliptic filters. Rs used only with elliptic filters. Defines stop band as Rs dB down from peak value in pass band.		

Parameter Dictionary

Word	Description
5-6	Coefficient a1. All filter coefficients are passed as 32-bit IEEE floating point numbers. The upper 32-bits should be passed first. If firmware designs filter then coefficients will be filled in by firmware and need not be passed.
7-8	Coefficient a2.
9-10	Coefficient b0.
11-12	Coefficient b1.
13-14	Coefficient b2.

Parameter Dictionary

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