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Model 5300
Quick Reference
Register Guide

The information in this document is current as of the following Hardware and Firmware revision levels. Some features may not be supported in earlier revisions. See www.ctc-control.com for the availability of firmware updates or contact CTC Technical Support.

Model Number	Hardware Revision	Firmware Revision
5300 series		>= 5.00.90R69.49

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General Registers

Register Number	Description
General Purpose Registers	
	General Purpose registers are 32-bit. They may be accessed for a variety of reasons.
1-8	**Internal counters**: R/W, counters may also be used as general purpose registers.
9-125	**General purpose registers**: R/W, data in these registers is stored in volatile memory
129-130	**General purpose registers**: R/W, (volatile)
133-500	**General purpose registers**: R/W, (volatile)
501-1000	**General purpose registers**: R/W, data is stored in nonvolatile memory.
32001-36000	**General purpose registers**: R/W, data is stored in nonvolatile memory.
Variant Registers	
36001-36100	**Local task volatile variant registers**: R/W. Each task has private set. Note that QuickBuilder uses the first 10, subject to change.
36101-36700	**Public volatile variant registers**: R/W.
36701-36800	**Public non-volatile variant registers**: R/W. Single element unless SDISK is installed in which case up to two dimensional arrays are supported.
36804	**Variant Selection Register**: R/W, selects which variant register is being referenced by registers 36805-36811.
36805	**Variant Column Size Register**: R Only, Number of columns in variant array.
36806	**Variant Row Size Register**: R Only, Number of rows in variant array.
36807	**Variant IndexCol Register**: R/W, Index for column array access, 0 default
36808	**Variant IndexRow Register**: R/W, Index for row array access, 0 default
36809	**Variant Indirection Register**: R/W, Nonzero value makes the contents of a variant reference a register number.
36810	**Variant Deletion Register**: R/W, writing a 0x55AA will cause the variant pointed to by the "Variant Selection Register" to be cleared (volatile) or deleted (Non-volatile).
36811	**Variant NVClose Register**: R/W, writing a 0x55AA will cause a non-volatile variant register file to be closed/flushed. Typically needed if copying or deleting the file.
36820	**QuickBuilder Variant Table reference** - Reserved
36821	**QuickBuilder Variant Property Name** - Reserved
36822	**QuickBuilder Axis Variant Property** – Reserved
36823	**QuickBuilder Common Bits Variant** - Reserved, (R/W) rows 0 to 255 represent global bits/flags used on 40X cards. Overlaps Common Var storage area, first 32 Common Vars (40X card has 256 Common Vars, first 32 are public).
36824	**QuickBuilder Common Vars Variant** - Reserved, (R/W) rows 0 to 31 represent global cvar used on 40X cards. Overlaps Common Bit area in 8 bit increments
36990	**QuickBuilder Write Filter** - Reserved
36991	**QuickBuilder Read Filter** - Reserved
36996	**QuickBuilder Task Step Lock** – Writing any non-zero value to this register will allow a step to maintain control beyond a single step, does not allow other tasks to execute until set back to 0.
Data Table Registers	
126	**Data table pointer**: R/W, used with column reference.
131-132	**Data table row and column pointers**: R/W, Used with register 9000
9000	**Access to the data table**: R/W, phantom - works with 131 & 132.

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Register Number	Description
Phantom Register	
127-128	Pointer for phantom register
Alternate Access to Resources	
1001-1999	**Digital Output Bits**: Alternate Access to Outputs 1-999: R/W, 0=off, 1=on.
2001-3024	**Digital Input Bits**: Alternate Access to Inputs 1-1024: R only, 0=open, 1=closed.
3025	**Digital Output Force Selection**: R/W, select Digital output to effect with Set/Clr, 1 based. (M3-20/21 only)
3026	**Digital Output Force Set**: R/W, set digital output (on), overriding application (M3-20/21 only)
3027	**Digital Output Force Clr**: R/W, clear digital output (off), overriding application (M3-20/21 only)
3028	**Digital Input Force Selection**: R/W, select Digital input to effect with Set/Clr, 1 based. (M3-20/21 only)
3029	**Digital Input Force Set**: R/W, set digital input simulation (M3-20/21 only)
3030	**Digital Input Force Clr**: R/W, clear digital input simulation (M3-20/21 only)
4816	**Digital Input Transition Scan Sample Time:** Number of ticks, minimum 2 (ms), 0 to disable (R/W, >= R19 firmware)
4817	**Digital Input Transition Group:** Input group to scan, 1 to 32, 11000 added to this, write will re-init change state registers to 0 (R/W).
4601-4632	**Digital Input Transition Individual Inputs:** R/W, Input transitions which occurred since armed (set to 1), write 1 to clear to 0 since are latched (R/W).
4832	**Digital Input Transition Group Input:** 32 bit representation of above (R Only).
10001-10032	**Digital Output Integer**: Access Outputs as a 32-bit number (R/W).
10101-10164	**Digital Output Short**: Access Outputs as a 16-bit number (R/W).
10201-10328	**Digital Output Byte**: Access Outputs as an 8-bit number (R/W).
11001-11032	**Digital Input Integer**: Access Inputs as a 32-bit number (R/W).
11101-11164	**Digital Input Short**: Access Inputs as a 16-bit number (R/W).
11201-11328	**Digital Input Byte**: Access inputs as an 8-bit number (R/W).
11401	**Digital Input Index:** 0 based input parameter setup for intelligent boards (M3-20 series, requires V1.09 & R63+ controller firmware)
11402	**Digital Input Debounce Time:** Number of timer ticks to debounce the input, where 0 is no debounce (R/W).
11403	**Digital Input Debounce Edge:** Input edge to debounce, 0 = falling, 1 = rising, 2 = both (R/W).
11404	**Digital Input Sample Delay:** Number of timer ticks to delay further input sampling after level detected (R/W).
11405	**Digital Input Sample Level:** Sample level to delay on, 0 = low, 1 = high, 2 = both (R/W).
11406	**Digital Input Tick Timer:** Current Input sample loop time in uS, R only.
11201-11328	**Digital Input Byte**: Access inputs as an 8-bit number: R only
Flags	
13005	**Flag Integer:** Access as a 32-bit number: R/W, Alternate access to Flags 1-32.
13021-13024	**Flag Byte**: Access as 8 bit number, group registers, 128 flags total.
13201-13328	**Flag Bit:** Access as a 1-bit number: R/W, 0 = off, 1 = on, 128 flags total.
Access to Analog Input and Output Points	
8001-8256	**Analog Output Value:** Alternate Access, R/W
8501-8756	**Analog Input Value:** Alternate Access, Read only

Register Number	Description
9001-9256	**Analog Input Conversion Type**: R/W, legacy access only.

Value	Description
0	**No Conversion, default**
10	K-Type Thermocouple Linearization Algorithm
11	J-Type Thermocouple Linearization Algorithm
12	T-Type Thermocouple Linearization Algorithm
13	E-Type Thermocouple Linearization Algorithm
14	R-Type Thermocouple Linearization Algorithm
15	S-Type Thermocouple Linearization Algorithm

Register Number	Description
9501-9756	**Analog Input Units**: R/W, legacy access only.

Value	Description
0	+/- 10,000 mVDC
1	**+/- 10,000,000 uVDC, default**
2	+/- 20,000 mVDC
3	+/- 20,000,000 uVDC
4	+/- 100,000 mVDC
5	+/- 100,000,000 mVDC
6	4,000 to 20,000 mADC
7	4,000,000 to 20,000,000 uADC
8	+/-20,000mADC
9	+/- 20,000,000 uADC
10	Not Used
11	Celsius, 1 implied decimal point, 250 = 25.0C (for CJC,RTD, and Thermocouple Conversions Only)
12	Fahrenheit, 1 implied decimal point, 250 = 25.0F (for CJC, RTD, and Thermocouple Conversions Only)
13	Kelvin, 1 implied decimal point, 250 = 25.0K (for CJC, RTD and Thermocouple Conversions Only)
14	Celsius, 2 implied decimal point, 2500 = 25.00C (for CJC,RTD, and Thermocouple Conversions Only)
15	Fahrenheit, 2 implied decimal point, 2500 = 25.00F (for CJC, RTD, and Thermocouple Conversions Only)
16	Kelvin, 2 implied decimal point, 2500 = 25.00K (for CJC, RTD and Thermocouple Conversions Only)

9989	**Analog Input Total Scan Time**: R/W, number of milliseconds to scan all analog inputs in the system. Register 9989/#boards = scan time per board. Default – 60 ms.
9990	**Analog Input Minimum Scan Time**: R/W, minimum number of milliseconds between board scans. If result of register 9989/#boards is too small then this becomes the default value. Default – 10 ms.
9991	**Analog Output Units Index**: R/W, 0 based (0 = output 1). Set this register to access the desired Analog Output channel for Unit (9992 register).

Register Number	Description
9992	**Analog Output Units**: R/W, actual units desired for general output write operation:

Value	Description
0	**+/- 10,000 mVDC, default**
1	+/- 10,000,000 uVDC
2	+/- 20,000 mVDC
3	+/- 20,000,000 uVDC
4	+/- 100,000 mVDC
5	+/- 100,000,000 mVDC
6	4,000 to 20,000 mADC
7	4,000,000 to 20,000,000 uADC
8	+/-20,000mADC
9	+/- 20,000,000 uADC

9993	**Analog Input Units/Conversion Index**: R/W, 0 based (0 = analog input 1). Set this register to access the desired Analog Input channel for Unit (9994 register) and Conversion Type (9995 register).
9994	**Analog Input Units**: R/W, same as 9501 – 9756 registers except access controlled by the channel index register 9993.
9995	**Analog Input Conversion Type:** R/W, same as 9001 – 9256 registers except access controlled by the channel index register 9993.
18501-18756	**Analog Input Digital Running Filter Length** (Default = 1): R/W, range 1 to 255.

Script and Flash Disk Registers

12311	**Script Execution**: R/W; writing a numeric to this register will cause the corresponding script to be executed. For example: writing a 4 to this register will cause `Script004.ini` to be executed. Adding 1000 to the value will cause the script to execute as a background thread. For example 1004 will run *Script004.ini* except as a background thread. Only scripts 000 to 019 may be run this way, reference 12340/12360/12380 register blocks for result information.
12312	**Script Execution Result**: Read only, 0 = busy, 1 = successfully executed, else error code (reference 951-520015).
12314	**Flash Disk Selection**: (R/W), 0 = root, 1 – n = drive mounted in sequence. Determines volume in which Flash Disk Space Register (12315) returns information. Typically 0 is internal flash, 1 is RAMDISK, and 2 is FLASHD (flash drive).
12315	**Flash Disk Space**: Read only, contains the approximate free space available on the flash disk.
12324	**Script Line Result**: Read only, contains the last error code that caused a foreground script to stop executing (Script #001 to 999).

Register Number	Description
12325	**Log File Name Selection**: R/W, writing a numeric to this register will define the Log/Data table file name (add 10,000 to the number below to execute in the background, recommended for flash): **Value** — **Description** **0-999** — Normal, Log###.log file written using log.ini **1000-1999** — Variant array is written to log file, Log###.log, log.ini not referenced **2000-2999** — Reserved **3000-3999** — Variant array is written to QS2 data table format using name datatable###.tab, log.ini not referenced. **4000-4999** — Reserved **5000-5999** — Varant array is loaded/read from QS2 data table format using name datatable###.tab
12326	**Log String Transfer**: R/W, write record number of 'log.ini' format file to reference and begin writing formatted record to *Log###.log* file. If using Variant then this becomes the variant register number.
12327	Log String Result: R, result of logging operation, 0 = success, -1 = busy, else error code (43 open error, 53 IO Access, reference 951-520015).
12328	**Log Deletion**: R/W, write the numeric value of the *Log###.log* file to delete. Add 10,000 to the value for background execution.
12329	**Snap Execution**: R/W, write the numeric value of the *Log###.log* file to rename to *Snap###.log*. Add 10,000 to the value for background execution.
12330	**Snap Result**: Read only, result of logging operation, 0 = success, 53 = failed, or not exist.
12331	**Snap Deletion**: R/W, write the numeric value of the *Snap###.log* file to delete. Add 10,000 to the value for background execution.
12332	**SDISK Monitor**: R/W, 0 SDISK not ready, 1 ready for access.
12340-12359	**Script Thread Result**: Read only, 0 = busy, 1 = successfully executed, else error code (reference 951-520015).
12360-12379	**Script Line Thread Result**: Read only, contains the last error code that caused a foreground script to stop executing.
12380-12399	**Script Line Thread Result**: Read only, contains the line specific error code returned upon abort of script, (reference 951-520015).
Serial Communications Registers	
12000	**Select Controller Communications Port**: W access, 1 = COM1, 2 = COM2, 6 – 12 = TCP raw virtual socket connections (see 22XX0 register descriptions).
12000	**Message Transmission Status** for Controllers: R access, 0 = not busy, 1 = busy.
12001	**Transmit Message from Data Table**: W only, Store row number to transmit.
12001-12255	**Controller Receive Buffer Access**, Read only, 1 character per location.
12300	**Protocol Variation**: R/W, Controls RS-232 terminal protocol modes. 0 = computer, 1 = terminal (default)
12301	**Serial Baud Rate Selection**: R/W, 2 = 1200, 3=2400, 4 = 4800, 5 = 9600, 6 = 19.2K (default), 7 = 38.4K, 8 = 57.6K, 9 = 115.2K.
12302	**Serial Input Buffer Counter**: (R) number of characters available. (W) any value to clear buffer and zero count.
12303	**Disable Automatic Parsing**: R/W, 0 = raw data processing except carriage return stops receiver and places 255 in Buffer Counter register (12302), 1 = resumes normal response to incoming messages, 128 for custom, raw data processing and receiver remains active regardless of data. When using 128 it is important to write a 0 to 12302 to clear the receive buffer.

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Register Number	Description
12304	**Extract Number from RS-232 Receive Buffer**: R only, Automatically assembles ASCII strings into a numeric value. The result is a signed 32-bit number. Automatically assembles strings of ASCII characters containing numeric information into a numeric value. Number multiplied by 10,000, allowing decimal points to 4 places.
12305	**Communications Priority**: R/W, when running multiple tasks. 0 = normal, 1 = priority. Not used on 5300, communications runs as background thread.
12308	**Serial Parity**: R/W, 0=None (default), 1=Odd, 2= Even
12309	**Serial Stop Bits**: R/W, 1 (default) or 2
12310	**Serial Data Bits**: R/W, 7 or 8 (default)
12313	**Serial Input Buffer Complete Counter**: R Only, Operational only when parsing is turned off (12303=0). When a buffer termination character is received 12302 has a 255 written to it and the length, including terminator is written to this register, 12313. When a 0 is written to 12302 to clear the count this counter is also cleared.
12316	**Message String Transfer Register**: R/W, write records number of `message.ini` file to send out serial port selected in 12000 register, read returns status with 0 = success. See the Model 5200 Script Configuration Guide.
12400	**Serial Buffer Parsing Terminator Character**: R/W, 0x0d (Carriage Return, default). May be set to any desired 8 bit character. The last received character is checked against this character when parsing is disabled, 12303 = 0. Once seen a 255 will be written to register 12302 and the actual present buffer length to 12313.
12320	**Serial Active Protocol Selection**: R/W; by default the protocol is set to CTC (0). Write to this port last after setting up any relevant parameters in other register, since this register enables the selected protocol immediately. CTC Binary & ASCII – 0 Modbus Master RTU – 1 (max of 120 16 bit Modbus Registers/block read; do not set manually, as it will be set when configuring the Modbus Master Register Control Block. Up to 256 may be read using automatic de-blocking feature of the Control Block) Modbus Master ASCII – 2 (max of 56 16 bit Modbus Registers/block read; do not set manually, as it will be set when configuring the Modbus Master Register Control Block. Up to 256 may be read using automatic de-blocking feature of the Control Block) Modbus Slave RTU – 3 (max of 120 16 bit Modbus Registers or 60 32 bit registers) Modbus Slave ASCII – 4 (max of 56 16 bit Modbus Registers or 28 32 bit registers) Diagnostic Terminal – 7 (telnet admin screen active, ^A ESC ESC to activate)
12321	**Serial Active Address**: R/W, address to be used by the controller, based upon the enabled protocol. By default the Global Serial Address is used unless overridden by writing a different one for the enabled port (12000 register) to this register. Currently on Modbus Slave protocols use this address. Modbus Master uses the Modbus Master Register Control Block, 21000 – 21299.
12322	**Global Serial Address**: R/W, Address to be used as the power up default for Modbus Slave Serial Protocols unless overridden by a write to register 12321. To save this value permanently a 1 must be written to register 20096.
12323	**Modbus Endian Swap** – R/W, if set to 1 (0, default) any time a 32 bit even boundary register is read via Modbus the 16 bits is swapped (H/L). 40001/3/5..., is even boundary in Modbus.
12337	**Modbus Bank1 Select** – R/W, used to read variant registers since Modbus does not allow reading great than 32K register and variants start at 36001. Value of 0, disables, else view window 9XXX has this value added to it to reference the actual register. Example if write 27000 here then when read/write 9101 will really be 36101.
12338	**Modbus Bank2 Select** – R/W, used to read variant registers since Modbus does not allow reading great than 32K register and variants start at 36001. Value of 0, disables, else view window 10XXX has this value added to it to reference the actual register. Example if write 26000 here then when read/write 10101 will really be 36101.
12339	**Modbus Bank3 Select** – R/W, used to read variant registers since Modbus does not allow reading great than 32K register and variants start at 36001. Value of 0, disables, else view window 11XXX has this value added to it to reference the actual register. Example if write 25000 here then when read/write 11101 will really be 36101.

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Register Number	Description
Ethernet Communications Registers	
20000	**CTNet Node Number**: R/W, Controller's node number, valid numbers are 1 - 32767. Requires power cycle after change.
20007	**Specify Connection Type**: R/W, 0 = Auto-negotiate (default), 10 = 10BaseT, 100 = 100BaseT.
20025-20028	**SNTP Server IP Address**: R/W, with 20025 being the first Octet, X.0.0.0, 20026 the second, 0.X.0.0, 20027 is the third, 0.0.X.0, and 20028 is the fourth, 0.0.0.X. Default is 192.43.244.18 (standard).
20041	**SNTP Server Port**: R/W, default is 123.
20042	**SNTP Update Time**: R/W; this register contains the number of seconds before the next synchronization request with the SNTP server. For example 3600 would be an hour, 86400 would be 24 hours. Default is 86400. When a change in time is made to this value it typically takes about 1 minute before the new value will take effect. Power cycling of the controller is not required.
20043	**SNTP Offset from GMT**: R/W, number of seconds to add or subtract from GMT, default is 0.
20048-51	**Controller IP Address**: R/W, with 20048 being the first Octet, X.0.0.0, 20049 the second, 0.X.0.0, 20050 is the third, 0.0.X.0, and 20051 is the fourth, 0.0.0.X. Set IP address to 0.0.0.0 to enable DHCP.
20064-67	**Controller Subnet Mask**: R/W, with 20064 being the first Octet, X.0.0.0, 20065 the second, 0.X.0.0, 20066 is the third, 0.0.X.0, and 20067 is the fourth, 0.0.0.X.
20080-83	**Controller Gateway Address**: R/W, with 20080 being the first Octet, X.0.0.0, 20081 the second, 0.X.0.0, 20082 is the third, 0.0.X.0, and 20083 is the fourth, 0.0.0.X.
20096	**Commit Settings to Nonvolatile memory**: (W) IP address, gateway, subnet, ctc node, sntp address, dns addres, system name, password, etc...
20097	**Restore Factory Defaults:** W only. Writing a 1 to this register will cause the `_startup.ini` file residing in `/_system/Scripts` directory to be deleted. Typically used to recover from a file that sets Security parameters in such a way as to totally restrict access.
20102	**Millisecond Timer**: R only. Range is -2,147,483,648 to +2,147,483,647
20128-20131	**DNS Server IP Address**: R/W with 20128 being the first Octet, X.0.0.0, 20129 the second, 0.X.0.0, 20130 is the third, 0.0.X.0, and 20131 is the fourth, 0.0.0.X. Set to 0.0.0.0 if DNS name resolution is not used (default).

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Register Number	Description
Ethernet Peer to Peer Registers	
23000-24999	**Remapped Register Block** – (R/W) Peer and Modbus data defined in registers 21000-21999 may be remapped to this consecutive data block starting at the register number designated in 21XX8, index 1007.

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Register Number	Description
21000-21299	**TCP Peer to Peer and Modbus Master Parameters**: R/W, starts at 21000 and repeated every 10 blocks as follows: **21XX0 – First Octet IP Address Register (Most Significant) – R/W** This is the first octet of the IP address (XXX.000.000.000) to connect to. **21XX1 – Second Octet IP Address Register – R/W** This is the second octet of the IP address (000.XXX.000.000) to connect to. **21XX2 – Third Octet IP Address Register – R/W** This is the third octet of the IP address (000.000.XXX.000) to connect to. **21XX3 – Fourth Octet IP Address Register (Least Significant) – R/W** This is the fourth octet of the IP address (000.000.000.XXX) to connect to. **21XX4 – Start Register – R/W** This register stores the starting register address that is to be read from the remote device. **21XX5 – Sequential Number Register – R/W** This register stores the number of sequential registers (starting with Register 21XX4) you want to read during a polling session. The value 1 represents a single register and the maximum number of registers allowed is 100 for Peer to Peer, 256 for Modbus and CTC Binary Master. Configure this register before setting up any other registers. Do not change this value during a transaction or all data will be lost and new values will have to be entered. If you modify this register, it lets you reset the connection. All register reads from remote devices will be the same block size. For Modbus Master this register is the default; see 21XXX8, 1011 to change when polling differing devices. This register must be written first to define the required storage size; upon initialization all other registers will become available. **21XX6 – Poll Timer Register – R/W** Set this register to 0 for a single read request else set the scan rate in milliseconds. The minimum value allowed is 50 ms for Peer to Peer and 10 ms for Modbus. You can write to this register at any time. **21XX7 – Status Flag Register – R** This register reflects the current status of the data registers. Its value is based on any requested operations. Typically, you initiate an operation and then wait for a status of 1. Possible values are: 0 - Offline; no connection is present. 1 - Last request is successful and completed. Data is available in the data registers if requested. Read or Write may now be done. -1 - Requested operation has failed; typically a Modbus Exception error -2 - Busy; connecting to the desired host. -3 - Busy; reading data. -4 - Busy; writing data. -5 – Timed out; poll timeout on a device by Modbus Master. -10 - Aborted operation; out of local memory or resources.

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Register Number	Description
21000-21299 Cont'd	**21XX8 – Index Offset Register – R/W** This register lets you access each of the requested sequential data registers. It works in conjunction with Register 21XX9 and acts as its array pointer. You can store the number of a general or special purpose register in 21XX8 and 21XX9 can then access the resource contained in the pointer. By default 0, this register points to the very first data element read from the remote device. This would be equivalent to what you set the Start Register to begin with (21XX4). Incrementing this register allows you to access other data elements, like an array. Register 21XX9 can then be read or written accordingly. The index register also has a few special features when you set it to 1000 or above. **1000 – Peer Request Time-Out Register** – (R/W) The timer starts when a peer node request is initiated and stops (times out) if no response is received within the time specified by this register. Retries only occur if automatic updates are active (Register 21XX6 is set to a value other than 0). Defaults are 500 ms for single register reads and time-out value*2.5 for automatically updated register read transactions. **1001 – Peer Request Failed Index Register** –(R) This register indicates when a peer transaction fails and an error occurs. The Status Flag Register (21XX7) is set to a value other than 1. Any data that was read or written when the error occurred has an offset value that is stored in 1001. If you read the data register, it returns the offset failure value. Data written before this offset value is valid. For example, if your process continuously updates 50 registers and the register returns a value of 25, it means the process failed while trying to write the 25th element of data. All data written before this element was written correctly. **1002 – Peer Request Retry Counter Index Register** – (R/W) This debugging register points the data register to the retry counter. Quickstep can set this register to any value. The register is incremented by 1 when a time-out occurs because of waiting for data from a peer node. **1003 – Protocol Index Register** – (R/W) This register tells the data register what protocol to use for setting the peer block registers. You must set this register before setting the Start Register (21XX4). Default mode is 0 for UDP Peer-to-Peer protocol. 2 is used for Modbus TCP Master mode, 3 for Modbus Master RTU Serial on COM1 (TBD), 8 is CTC Binary Master UDP (port 3000), 9 is CTC Binary Master TCP (port 6000). Note the Binary Master protocol allows connection to 2700 series controllers. **1004 – TCP Client Port Index Register** – (R/W) This register points the data register to the destination TCP Port address for your connection. You must set this register before setting the Start Register (21XX4). 1004 is currently used for Modbus TCP and serial Master mode with a default port number of 502 for TCP and 1 for serial (COM1). Not used for the CTC Binary Master protocol. For that protocol it is fixed to 3000 for UDP and 6000 for TCP.

Register Number	Description
21000-21299 Cont'd	**1005 – Modbus Master Unit ID Index Register** – (R/W) This register points the data register to the Device/Unit ID field value used in the Modbus Master request packet. The default ID is '1' but you can set it to any desired value. This ID affects all subsequent transmissions and allows multiplexed devices to be addressed in a Modbus environment. **1006 – Modbus Master Exception Index Register** – (R) This register allows you to interrogate the last Modbus Exception error code received from the data register (21XX9). Referencing this register helps to interpret failure types. Typically you would reference this register if a '-1' appears as the current status in register 21XX7. **1007 – Register Remapping Start Index Register** – (R/W) This option allows remote registers to be mapped into the 23000 to 24999 consecutive memory space. Previously an index register at 21XX8 needed to be set then data read from 21XX9. This can result in slow operation if a lot of data needs to be transferred. Setting 21XX8 to 1007 and then writing the register value from 23000 to 24999 will allow all data to be remapped to that register block area, consecutively, based upon the block size (21XX5). A write to the remapped area will result in a remote write. By default re-mapping is not active. **1008 – Modbus Master MAX Retries Register** – (R/W) This register allows you to change the maximum number of retry attempts on a Unit ID before giving up. Default is 2. **1009 – Modbus Master Retry Counter Register** – (R/W) This register allows you to observe and change the current number of message retries to the current Unit ID. **1010 – Modbus Master Timeout Register** – (R/W) This register allows you to change the default Unit ID timeout from 50 milliseconds to that desired, in milliseconds. **1011 – Modbus Master Block Size Register** – (R/W) This register sets the number of Holding Registers to be accessed. Must be the same or smaller than the Sequential Number Register, defaults to the same. Used to access Unit ID's with varying block sizes when manually changing the Unit ID under program control. **1012 – Random Index Register** – (R/W) CTC Binary Master protocol only. -1 default, with 1013 of -1 means normal peer to peer automatic sequential registers. If 1013 is not -1 then this register may be used to offset to the 1014 register window. All values appear in 21XX9. Writing a -1 to this register clears the registers set by writes to the Random Register Window and restores sequential mode. Typically this register is not accessed. After setting random registers (1014) it can be used to view what has been set. In other words setting this to a 2 would cause the third (0 based) register to be selected in the Random Register Window when that index is set.

Register Number	Description
Ethernet Virtual IO Registers	

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Register Number	Description
21600 – 21999	***1013 - Number of Random Registers Initialized*** *– (R Only) CTC Binary Master protocol only. Number of random registers initialized, up to 21XX5 max. -1 means none, default (sequential mode). All values appear in 21XX9. Note that this is only if random access mode is being used, else -1 means sequential, reference offset 1014 for further information.* ***1014 - Random Register Window*** *– (R/W) CTC Binary Master protocol only. During initialization write the desired sequence to 21XX9 with 21XX8 set to 1014 and that will be the registers scanned, up to 256. If you do nothing sequential mode is use and accessed registers begin with that specified in 21XX4.* *Each write automatically increments the index. If a 0 is set, or not all the registers are set to a value, the default will be sequential for the remaining registers. For example if 5 registers are to be scanned and only write 4 times to this register, the first 4 accessed will be what was written, since the last register was not set the sequential mode will be used for that and since this is offset 4, the starting register 21XX4 is referenced, if 21XX4 was 1, 1 + 4 (0 based), register 5 would be accessed for that slot.* *Once initialized offset 1012 may be modified to change a register, base 0 (first). Writing a -1 to 1012 will clear the stored registers and put it back to sequential mode. Do not do this while connected.* ***1015 – Multidrop Indicator Register*** *– (R Only) Used in Modbus Master Serial mode to indicate that the serial port being used has more than one poll definition for it and is currently in multidrop mode. 0 = normal single poll address, 1 = multidrop.* ***1016 – Modus Access Register*** *– (R/W) By default Modbus Master polls the 4XXXX block of Modbus registers known as Holding Registers. To access an alternate register block set register as follows:* ***0*** *– (0XXXX) Coils, each coil represents a 32 bit value, 1 or 0, r/w.* ***1*** *– (1XXXX) Input Status (read only), each input represents a 32 bit value, 1 or 0.* ***3*** *– (3XXXX) Input Registers (read only), 16 bit value stored in 32 bit register.* ***4*** *– (4XXXX) Holding Registers, r/w, default, 16 bit value stored in 32 bit register.* ***1017 – Multidrop Offline Loop Count Register*** *– (R/W) Used in Modbus Master Serial mode to define the number of online poll cycles to complete before attempting an offline node. By default this is 10 polls of online nodes to every one of an offline node. After each cycle a different offline node will be attempted.* ***1996– Modbus Master Block Write Offset Register*** *– (R/W) Used in Modbus Master mode to define the offset from the 23XXX (index 1007) mapped block to start a block write operation when a 1 is written to index 1998. The default is 0, meaning the start of the defined 23XXX remap block for this connection.* ***1997– Modbus Master Block Write Length Register*** *– (R/W) Used in Modbus Master mode to define the number of modbus registers from the offset of the 1996 index registers to write when a 1 is written to index 1998. The default is 0, meaning disabled, the entire block will be written 21XX5 length.* ***1998 – Modbus Master Block Write Register*** *– (R/W) Used in Modbus Master mode to control 23XXX remapped write operations . By default each write to 23XXX will cause a single write to the slave device. Optionally read operations can be put on hold and a block write operation may be performed. This is done by writing a 0 to this location, writing the 23XXX (index 1007) mapped registers with the desired value, and then writing a 1 to this location. The 1 will initiate the block write operation. Monitor the status register (21XX7) for completion. Each time a 1 is written a block write will occur with the data present. Modbus data is still being polled but is not being updated into the 23XXX block until a 2 is written to 1998, thus clearing the Block Write and restoring normal operation.* ***21XX9 - Data Registers - R/W*** *This phantom register contains peer data that is read or written in a peer transaction. It is a "window" into a register array in the controller. The array size is set by Register 21XX5 and the offset is specified by Register 21XX8. Data integrity is indicated in Register 21XX7. Array data can be mapped to the 23000 block instead of using this register (21XX8, 1007).*

Register Number	Description
21600 – 21999 Cont'd	

Example CTC Binary Master Setup:

IP address of external controller 12.40.53.9. Desire to monitor Registers 13002, 1, 16, 25, and 1001 and map it to the 23000 block:

```
21005 = 5     // Number of registers (Must be set first)
21004 = 1     // First register of block, set to 1 so have default
              //  value if don't fill in all registers, required.
21000 = 12    // IP address of remote controller, 12.40.53.9
21001 = 40
21002 = 53
21003 = 9
21008 = 1003    // Protocol index setting
21009 = 8       // 8 is CTC Binary Master UDP, 9 is TCP (think of
                //  5300 being CTCMON or VB type access)
21008 = 1014    // Select the random register window
21009 = 13002   // Set registers to monitor, automatically
                // increments offset 1013
21009 = 1
21009 = 16
21009 = 25
21009 = 1001
21008 = 1007    // Select the remapping register
21009 = 23000   // 23000 to 23015 will be output registers in remote
                //  controller
21008 = 0       // Reset the index
21006 = 100     // Starts the scanning and no further changes allowed
                // (must be set last to start scan)
```

21007 will be 1 when online, -2 if connecting, 0 offline, -4 writing.

Multiple sessions allowed of differing type, sequential as is standard peer to peer and random.

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Register Number	Description

Ethernet TCP RAW Socket Registers

22000-22199	TCP Raw Socket Session Parameters: R/W, starts at 22000 and repeated every 10 blocks (max of 20 RAW sockets) as follows: **22XX0** – Serial port ID register, offset 0, range 6 – 15. **22XX1** – Client/Server register, offset 1, to initiate connection set to a 0, if controller is a server set to a 1. **22XX2** – Most significant octet of IP Address to connect to if client mode, IPA, offset 2. If server mode this is the default protocol to run as a server, uses same codes as register 12320 (default 0, Modbus Master not supported). **22XX3** – IP Address octet, IPB if client mode, offset 3. If server mode this is the SET/CLR parsing control (similar to register 12303), typically set to 0 for custom, else 1 for normal. **22XX4** – IP Address octet, IPC if client mode, offset 4. If server mode this is the server address to use, typically for Modbus applications, reference register 12321. **22XX5** – Least significant octet of IP Address to connect to, IPD if client mode, offset 5. If server mode write a 0 to this location. **22XX6** – Port to connect to (client) or listen on (server), offset 6 **22XX7** – Connection status register, offset 7, on read, -1 = not initialized, 0 = offline, 1 = online, write a 1 to initiate connection or start server thread. **22XX8** – Index register to offset to data, offset 8. Recommend using serial port buffer, not this interface but available to mimic the peer to peer interface. **22XX9** – Data array, offset 9. Recommend using serial port buffer commands, not this interface but available to mimic the peer to peer interface.

Diagnostic Registers

13030	**Debug Slot**: R/W, slot selection for accessing backplane addresses.
13031	**Debug Stack Limit**: R only
30000-31023	**Debug Board**: R/W, allows offset into backplane memory structure.
13049	**Boot Sequence Status**: R only, not used.

Special Functions

Software Pulse Width Modulated Outputs

5901, 5905	**Pulse Output Count**: R/W, Number of pulses to send out of outputs 1 and 2 respectively. Storing 65535 sends pulses continuously. Any other number of pulses stored here will count down as they are output. Note: Set this register last as it will initiate the pulse upon a non-zero value.
5902, 5906	**Pulse Time Output**: R only, Current time output has been outputting pulses in ms. For output 1 and 2 respectively.
5903, 5907	**Pulse ON Time**: R/W, PWM pulse "on time" in mSec. 1 mSec minimum. Set this register prior to the Pulse Output Count register.
5904, 5908	**Pulse Period**: R/W, PWM pulse period or interval in mSec. 2 mSec minimum. Set this register prior to the Pulse Output Count register.

M3-20/21 A, C Hardware Pulse Width Modulated Outputs

4000	**# of PWM**: R, Number of hardware PWM available in the system (0 to 128)
4001-4128	**Pulse Output Count**: R/W, Number of pulses to send out of output. Storing -1 (0xFFFFFFFF) sends pulses continuously. Any other number of pulses stored here will count down as they are output. Note: Set this register last as it will initiate the pulse upon a non-zero value. Note: The output is not under QS2 control, but is disabled during PWM operation.

4129-4256	**Pulse ON Time**: R/W, PWM pulse "on time" in ticks. 40uS for just PWM, 80uS if counters and PWM enabled. Default = 0 (off).
4257-4384	**Pulse Period (length)**: R/W, PWM pulse period or interval in ticks. 40uS for just PWM, 80uS if counters and PWM enabled.

PLS Function (Special Option)

5910	**Data Table Row Pointer**: R/W, Specifies the beginning of the PLS area.
5911-5929	**PLS Control** Registers
5951-5966	Output Transition Enable: R/W, 0 = output ignores PLS control, 1 = PLS functions controls output state.
5971 - 5986	**Active Column Pointer**: R only, indicates the active column number in the Data Table for each row and output. 1 per row.

Real-Time Clock

13002	**Continuous millisecond counter**: R/W, increments every 1 millisecond. Range is -2,147,483,648 to +2,147,483,647.
13013	**RTC Lock**: R/W, 0 = locked from write operations, 1 = unlocked, OK to write
13014	**Seconds**: R/W
13015	**Minutes**: R/W
13016	**Hours**: R/W, 24 hour clock
13017	**Day of Month**: R/W
13018	**Month of Year**: R/W, 1-12
13019	**Year**: R/W, Two fields
13020	**Day of Week**: R/W, 1-7, where Monday = 1

Tasks

13011	**Task Priority**: R/W, Specifies Super Task serviced on a priority basis. 1000 = Currently executing task
13012	**Current Task Number**: R only
13032	**Task Register Fault Status**: R only
13033	**Task Register Fault Step**: R only
13034	**Task Register Fault Task**: R only
13035	**Task Register Fault Data**: R only
13036	**Performance Adjustment Register** (PAR): R/W, Number of milliseconds till Quickstep opens network service window. 10 <= PAR <= 250 (smaller PAR > Network Performance)
13037	**Network Service Window** (NSW): R/W, 5 ms. X this value = number of ms. Network window allowed to be open. If no service is required, or is complete the window is closed immediately and Quickstep uses the extra time for its own execution. 2 <= NSW <= 14 (larger NSW > Network Performance).
13101-13164	**Delay Timer** Registers
13038	**Fault Step** – (R/W) Step to branch to when fault occurs. Write a 0 to disable.
13039	**Fault Task** – (R) Task number that is the active Fault Handler, 0 means none.
13040	**Fault Mask** – (R/W) Bit OR types of fault that will invoke the handler, by default all enabled (-1) when the Fault Step Register is written
13041	**Fault Clear** – (W) Used to write the recovery state when done processing the Fault.
13050	**Total Tasks Running** – R, Total number of active tasks
13051	**TASK Loop Execution** – R, time in ticks (1 ms typically) to execute the last full task loop.
13052	**TASK Min Execution** – R, min ticks a task took to execute.
13053	**TASK Max Execution** – R, max ticks a task took to execute.

13054	**Quickstep 2 Execution State** – R/W

Program State	Description
1	RESET – Reset the controller only and then stop..
5	RESTART – Reset the controller and begin running again at step 1.
6	STOPPED – Stop the controller but do not reset.
8	RUNNING – Ignore the fault and continue running.
9	FAULT – Continue to fault as usual.
10	SHUTDOWN – Reset the controller and shutdown, requires a power cycle to exit.

12305	**Serial Thread Priority** – R/W, Increase serial port processing priority by 1, 0 disables (default), 1 enables.
12306	**FTP Thread Priority** – R/W, Increase ftp processing priority by 1, 0 disables (default), 1 enables. Note that Quickbuilder uses this register to temporarily speed up project downloads.
12307	**Web Thread Priority** – R/W, Increase web (http) processing priority by 1, 0 disables (default), 1 enables.

High Speed Counters

TBD

General Hardware Counters

3040	**Available Counters** – R, number of counters available, M3-20 boards have 16 per board (8 per board <= V1.09).
3041–3168	**Counter Mode M3-20A, C & M3-21A, C:** R/W, Counter configuration. (Firmware V1.10 and greater). Note that mode settings are for input/output pairs such that 3041 is for IO 1 and 8, 3042 is for IO 2 and 9, etc... Control Register (default = 0x00D4) -- b:0 -> Clock Edge control 0 = Count on Rising Edge (Default) 1 = Count on Falling Edge. -- b:1 -> Direction Control 0 = Increment (Up counter) active low (Default) 1 = Decrement (Down counter) active high. -- b:2 -> Reset Control 0 = Reset active low. 1 = Reset active high (Default). -- b:3 -> PWM 16 Enable (V1.09 firmware, else 0) 0 = 8 PWM Outputs, 9 to 16 (DEFAULT) 12500HZ Max, 40uS/count, no counters enabled 1 = 16 PWM Outputs, 9 to 16 (PWM 1 to 8) Outputs 1 to 8 (PWM 9 to 16) 6250HZ Max, 80uS/count -- b:4 -> Counter Type (only UP/DOWN supported) 0 = Reserved 1 = UP/DOWN Mode (Default) -- b:5 -> Set Point Output Enable 0 = Set Point Not Enabled (Default)

1 = Set Point Enabled
-- b:6 -> Counter Setpoint State
0 = Output OFF when logic is true
1 = Output ON when logic is true (Default)
-- b:8/7 -> Setpoint Logic
00 = N/A
01 = value >= Setpoint (Default)
10 = value <= Setpoint
11 = value = Setpoint
-- b:9..11 -> Reserved
0 = (DEFAULT)
-- b:12 -> Reset Enable
0 = Reset Input disabled (DEFAULT)
1 = Reset Input enabled (reference bit 13)
-- b:13 -> Upper/Lower Byte Select
0 = Counter inputs 1 to 8 (Default)
Reset inputs 9 to 16
1 = Counter inputs 9 to 16
Resets input 1 to 8
-- b:14 -> PWM Enable
0 = PWM disabled (Default)
1 = PWM enabled
-- b:15 -> Counter Enable
0 = Counter disabled (Default)
1 = Counter enabled
-- b:16 -> Debounce 1 to 8 Input Enable
0 = Debounce disabled (Default)
1 = Debounce enabled
-- b:17 -> Debounce 9 to 16 Input Enable
0 = Debounce disabled (Default)
1 = Debounce enabled
-- b:18 -> Sample Delay 1 to 8 Enable
0 = Sample Delay disabled (Default)
1 = Sample Delay enabled
-- b:19 -> Sample Delay Enable 9 to 16 Enable
0 = Sample Delay disabled (Default)
1 = Sample Delay enabled
-- b:20 -> Counter Enable (enable 16 counters, no reset, setpoint, or preload)
0 = 16 Counter mode disabled (Default)
1 = 16 Counter mode enabled (direction/edge shared 1/8, 2/9...)
-- b:31 -> Setpoint Active (read only)
0 – Not Active
1 – Active (in setpoint range)

(b – bit)

Note: Default input tick sample rate is 40uS per feature enabled, additive. Thus 40uS for 8 PWM (80uS period), 80

	uS for 16 PWM (160 uS period), +40uS for each 8 counters, +40uS for debounce (1 to 16), and +40uS for sample Delay (1 to 16). Thus if debounce and sample delay are enabled an 80uS sample input tick rate would be used. Reference Register 11406 for the current active sample tick time used on the module. Do not enable a counter for the first time during a PWM output or the clock speed will change during the output. This means that if you plan on using PWM and counters at the same time then you should always leave one of each enabled to force the constant sample time. If you enable and disable different features you will affect the sample rate.
3169-3296	**Counter Value**: R/W, Counter value. Current count value.
3297-3424	**Counter Preload (Reset) Value**: R/W, value to load into the register when started or reaches maximum count.
3425-3552	**Counter Setpoint Value**: R/W, On M3-2X cards this is a single value referenced by the Counter MODE register.

Miscellaneous Special Functions

5801-5808	TBD
6500	**Snapshot of Controller's Step Status**: W only, Writing any value triggers snapshot.
6500	**Number of Active Tasks**: R only, Must write to this register before reading it. (See above.)
6501-6564	**Step Number of Active Tasks**: R only, Lists the step numbers of active tasks.
13001	**Compile Option**: R only
13003	**Revision level of Firmware**: R only, Multiplied x 100.
13004	**Controller Architecture**: R only, 1 indicates CTC's expanded architecture.
13007	**Serial Number**: R only
13008	**Controller Model Code**: R/W, Must be set to 3 to use CT Utilities. (DOS version)
13009	**Automatically Turn Off Output at Software Fault**: R/W, Storing an output number to this register and then turning that output ON in your program will cause that output to turn OFF in the event of any program software fault. This is commonly used to control a relay circuit that will drop out field power if a software fault occurs, for any reason.
29999	**System Delay** (R/W), causes processing to stop for value written milliseconds.

DeviceNet Functions

DeviceNet

	See Manual for additional details.
12333	**Master Board Select** (R/W), Set register 1 to N to select which board's node status should appear in 13400 – 13464 registers.
13400-13463	**Node Status** (R Only), Represents status of MAC ID 0 to 63. 0 if offline, 1 if online and operations, else fault definition as below. Register 12333 selects which Master card to monitor. Only valid for DeviceNet Master Modules. See DeviceNet Master manual for specific status codes.
13464	**Online Status** (R Only), 0 if offline or faulted, 1 if online and scanning configured nodes. Register 12333 selects which Master card to monitor. Valid for Ethernet/IP and DeviceNet Module.

Motion Control Functions (Running 2219 Simulation MSB)

Motion Registers Grouped by function then axis

	The 5300 firmware is designed to access up to 16 axes. For the 14XXX register values below substitute the axis number for '**ax**' to get the correct register. **Axis #1 = 1**; For example the position of axis #1 is stored in register 14001.

<table>
<tr><td>140ax</td><td>Position (counts), R only [QuickBuilder reference = fposc]</td></tr>
<tr><td>141ax</td><td>Error (counts), R only [QuickBuilder reference = perr * ppr * (uun/uud)]</td></tr>
<tr><td>142ax</td><td>Velocity (counts / sec), R only [QuickBuilder reference = vel * ppr * (uun/uud)]</td></tr>
<tr><td>143ax</td><td>Status, R only:

<table>
<tr><th>Status</th><th>Description</th></tr>
<tr><td>0</td><td>Axis not initialized</td></tr>
<tr><td>1</td><td>Stopped and ready</td></tr>
<tr><td>2</td><td>Motion imminent: waiting for start</td></tr>
<tr><td>3</td><td>Accelerating</td></tr>
<tr><td>4</td><td>At max speed.</td></tr>
<tr><td>5</td><td>Decelerating to new max speed</td></tr>
<tr><td>6</td><td>Decelerating to stop</td></tr>
<tr><td>7</td><td>Soft stop</td></tr>
<tr><td>8</td><td>Registration move (armed, not moving)</td></tr>
<tr><td>9</td><td>Home</td></tr>
<tr><td>10</td><td>Following (not used)</td></tr>
<tr><td>128–255</td><td>Error (not used)</td></tr>
</table></td></tr>
<tr><td>144ax</td><td>Integral Error (count-seconds), R only (not supported)</td></tr>
<tr><td>145ax</td><td>Velocity Feedforward [QuickBuilder reference =QS2_VAR_NEW_VEL_FEEDFORWARD]</td></tr>
<tr><td>146ax</td><td>Deceleration (counts/sec^2) [QuickBuilder reference = QS2_NEW_DECELERATION]</td></tr>
<tr><td>147ax</td><td>Dedicated Inputs, R only:
This is a bit map of the input signals
<table>
<tr><th>Bit Number</th><th>Description</th><th>Bit Number</th><th>Description</th></tr>
<tr><td>0 (lsb)</td><td>Reg. (not supported)</td><td>4</td><td>Rev EOT</td></tr>
<tr><td>1</td><td>Home</td><td>5</td><td>Fwd EOT</td></tr>
<tr><td>2</td><td>Start</td><td>6</td><td>Z/Index (not supported)</td></tr>
<tr><td>3</td><td>Kill</td><td>7</td><td>Not Used</td></tr>
</table></td></tr>
<tr><td>148ax</td><td>Acceleration Feedforward [QuickBuilder reference = QS2_VAR_NEW_ACC_FEEDFORWARD]</td></tr>
</table>

149ax	**Analog Output**, **R/W** - 32,767 = -10.000V; 32,767 = 10.000V, [QuickBuilder reference = rint(dac_mv * 3.2767)]

Motion Registers Grouped by axis then function

	For the 15xxx, 16xxx, 17xxx register values below substitute the axis number for '**bx**' to get the correct register. Axis **#1 = 0**; For example the position of axis #1 is stored in register 15000.
15bx0	**Position** (counts), R only [QuickBuilder reference = fposc]
15bx1	**Error** (counts), R only [QuickBuilder reference = perr * ppr * (uun/uud)]
15bx2	**Velocity** (counts / sec), R only [QuickBuilder reference = vel * ppr * (uun/uud)]
15bx3	**Status**, R only:

Value	*Description*	*Value*	*Description*
0	Axis not initialized	6	Decelerating to stop
1	Stopped and ready	7	Soft stop (not used)
2	Motion imminent: waiting for start	8	Registration move (armed, not moving)
3	Accelerating	9	Home
4	At MAX speed	10	Following (not used)
5	Decelerating to new MAX speed	128-255	Error (not used)

15bx4	**Integral Error** (count-seconds), R only **(not supported)**
15bx5	**Velocity Feedforward**, ~~**also used to specify the Output in Direct mode**~~ [QuickBuilder reference = QS2_VAR_NEW_VEL_FEEDFORWARD], output in direct mode not supported, use Analog Output instead (15bx9).
15bx6	**Deceleration** (counts/sec^2), R only [QuickBuilder reference = QS2_NEW_DECELERATION]
15bx7	**Dedicated Inputs**, R only: **This is a bit map of the input signals**

<table>
<tr><td></td><td>
<table>
<tr><th>Bit Number</th><th>Description</th><th>Bit Number</th><th>Description</th></tr>
<tr><td>0 (lsb)</td><td>Reg. (not supported)</td><td>4</td><td>Rev EOT</td></tr>
<tr><td>1</td><td>Home</td><td>5</td><td>Fwd EOT</td></tr>
<tr><td>2</td><td>Start</td><td>6</td><td>Z/Index (not supported)</td></tr>
<tr><td>3</td><td>Kill</td><td>7</td><td>Not Used</td></tr>
</table>
</td></tr>
<tr><td>15bx8</td><td>Acceleration Feedforward [QuickBuilder reference = QS2_VAR_NEW_ACC_FEEDFORWARD]</td></tr>
<tr><td>15bx9</td><td>Analog Output, R/W -32,767 = -10.000V; 32,767 = 10.000V [QuickBuilder reference = rint(dac_mv * 3.2767)]. On 2219 this is read only and Velocity Feedforward is written to for Analog Output.</td></tr>
<tr><td>16bx0</td><td>Reg. Start, R/W – Position at which the registration will be enabled [QuickBuilder reference = QS2_CAP_WINSTART]</td></tr>
<tr><td>16bx1</td><td>Reg. Window, R/W – The range that the registration will be enabled [QuickBuilder reference = QS2_CAP_WINEND_REL]</td></tr>
<tr><td>16bx2</td><td>Reg. Position, R only – The position at which the registration was detected, when Reg status is 1 [QuickBuilder reference = capposc]</td></tr>
<tr><td>16bx3</td><td>Reg. Offset, R/W – The distance to be moved after the registration input [QuickBuilder reference = QS2_CAP_WINOFFSET]</td></tr>
<tr><td>16bx4</td><td>Reg. Status, R/W – 0 = Armed (write 0 to arm), 1 = Detected, can only set to 0 [QuickBuilder reference = QS2_REG_STATUS]</td></tr>
<tr><td>16bx5</td><td>Numerator, R/W – For following the master axis [QuickBuilder reference = QS2_VAR_MTN]</td></tr>
<tr><td>16bx6</td><td>Denominator, R/W – For following the master axis [QuickBuilder reference = QS2_VAR_MTD]</td></tr>
<tr><td>16bx7</td><td>Leader Position, R only – Only valid when following a master axis (not supported)</td></tr>
<tr><td>16bx8</td><td>Leader Velocity, R only – Only valid when following a master axis (not supported)</td></tr>
<tr><td>16bx9</td><td>Reserved</td></tr>
<tr><td>17bx0</td><td>Firmware Revision, R only</td></tr>
<tr><td>17bx1</td><td>Filter & Mode, R/W:
~~In Direct mode the Feedforward Velocity gain specifies the output value (0 to 32767) with a value of 32767 = 10V (sign depends on the Filter type)~~. [QuickBuilder reference = QS2_FILTER_MODE]
<table>
<tr><th>Description</th><th>Value</th></tr>
<tr><td>Lower 3 bits (0x07)
Filter type</td><td>0 or 3 = PID
1 = + Direct (CW) 2 = - Direct (CCW)
4 = PAVff 5 = PAV
6 = Stepper 7 = Initialize Encoder</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>Resolution</td></tr>
<tr><td>Bits 4 & 5
Accel/Decel Type</td><td>0 = Linear 1 = S Curve
~~2 = Parabolic~~ ~~3 = Inverse Parabolic~~</td></tr>
<tr><td>Bit 7 (0x80)</td><td>0=Trajectory Following
1 (value 128) = Encoder Following</td></tr>
</table>

Note: Initialize Encoder Resolution, filter type 7 is only a temporary mode that can be applied anytime there is no motion. It is recommended this be done prior to initial motion. This can be used to override the default ppr, mppr, and sppr. Upon writing this value the following registers will be initialized as follows, thus set accordingly prior to execution:

ppr = QS2_VAR_NEW_VEL_FEEDFORWARD
mppr = QS2_VAR_NEW_ACC_FEEDFORWARD
sppr = QS2_NEW_DECELERATION

After changing the above variables set them back to their previous values and set the Filter Mode to the proper mode for motion desired.</td></tr>
<tr><td>17bx2</td><td>Input Polarity, R/W:
This is a bit map that controls the active level of the input signals,. When the bit is 0 then the input is active when it is On; if the bit is 0 then the input is active Off.
<table>
<tr><th>Bit Number</th><th>Description</th><th>Bit Number</th><th>Description</th></tr>
<tr><td>0 (lsb)</td><td>Reg. (not supported)</td><td>4</td><td>Rev EOT</td></tr>
<tr><td>1</td><td>Home</td><td>5</td><td>Fwd EOT</td></tr>
<tr><td>2</td><td>Start</td><td>6</td><td>Z/Index (not supported)</td></tr>
<tr><td>3</td><td>Kill</td><td>7</td><td>Not Used</td></tr>
</table></td></tr>
<tr><td>17bx3</td><td>Home Direction, R/W [QuickBuilder reference = QS2_HOME]

<table>
<tr><th>Direction</th><th>Description</th></tr>
<tr><td>CCW</td><td>0 or –1 = Home & Index
-2 = Home Only
-3 = Index Only (not supported)</td></tr>
<tr><td>CW</td><td>1 = Home & Index
2 = Home Only
3 = Index Only (not supported)</td></tr>
</table></td></tr>
<tr><td>17bx4</td><td>Options, R only (not supported)</td></tr>
<tr><td>17bx5</td><td>Reserved</td></tr>
</table>

17bx6	**Maximum Following Error, R/W** default = 30000 [QuickBuilder reference = perrlimit * ppr]]
17bx7	**Speed Limit, R/W** – overrides maximum velocity, default = 4194303 steps/sec (not supported)
17bx8	**Maximum Position, R/W** – Used as a Software EOT when it is larger than the Minimum Position (not supported)
17bx9	**Minimum Position, R/W** – Used as a Software EOT when it is smaller than the Maximum Position (not supported)

Notes

1. R indicates read, W indicates write.
2. Default settings are in **bold** print.