

6K Ethernet Driver Specification Revision 1.3



This document describes the 6K Ethernet implementation for those developing their own Ethernet drivers. If you are using the communications server (com6srvr.exe) that is included with Motion Planner then you do not need to refer to this document.

This specification pertains to:

- 6K operating system revision 5.1.2 and greater

6K Ethernet Description

The 6K series of motion controllers contains an Ethernet interface for communication. Four ports are available for connection:

1. The alarm/variable port (port 5001) is used to set 6K variables and receive 6K status information in a binary format.
2. The communication port (port 5002) is used to transmit and receive the standard 6K ASCII command set.
3. The status port (port 5003) is used to enable and set a status update interval and retrieve that status information in a binary format.
4. The watchdog port (port 5004) is used to monitor the integrity of the Ethernet connection.

The 6K acts as a server and executes a passive open on the TCP/IP ports (5001, 5002 and 5004). The UDP/IP port (5003) is available when the communication port (5002) connects.

The 6K utilizes a 68340 microprocessor which requires that the multi-byte fields be transmitted and received with the most significant byte first and the least significant byte last.

For information on the 6K Ethernet commands, see the 6K Series Command Reference and the 6K User Guide Addendum.

PORT 5001 (TCP/IP Variables & Single Shot Status)

A. Receive Description

This port receives 192 bytes per packet to set 6K variables or to request a status update transmitted on this port. The data is memory mapped, thus, 192 bytes must be sent per packet.

The first 4 bytes comprise the variable mask to identify which variables are being modified in this transmission. The next 8 bytes are reserved for future use (set the bytes to 0). The next 4 bytes comprise another mask of which bits 0 and 1 are the only ones used at present. If bit 0 is set, then the status information is transmitted on this port. If bit 1 is set, then the status information expands to include real variables. The other bits are reserved and should be set to 0.

- Integer variables (VARI) are signed 32 bit numbers.
- Variables (VAR) are signed 64 bit numbers in units of 100 millionths.
- Binary variables (VARB) are 32 bit numbers.

Receive Packet (port 5001) Data Description:

Function	Size	Description (* Indicates bit information included below)
Variable Mask	4 bytes	Variable mask to identify variables modified in this transmission. (see bit descriptions below)
Reserved	4 bytes	Reserved (set to 0)
Reserved	4 bytes	Reserved (set to 0)
Action Mask	4 bytes	Sets the fast status packet size. (see bit descriptions below)
Integer Variable 1	4 bytes	Contents of VARI1
Integer Variable 2	4 bytes	Contents of VARI2
Integer Variable 3	4 bytes	Contents of VARI3
Integer Variable 4	4 bytes	Contents of VARI4
Integer Variable 5	4 bytes	Contents of VARI5
Integer Variable 6	4 bytes	Contents of VARI6
Integer Variable 7	4 bytes	Contents of VARI7
Integer Variable 8	4 bytes	Contents of VARI8
Integer Variable 9	4 bytes	Contents of VARI9
Integer Variable 10	4 bytes	Contents of VARI10
Integer Variable 11	4 bytes	Contents of VARI11
Integer Variable 12	4 bytes	Contents of VARI12
Real Variable 1	8 bytes	Contents of VAR1
Real Variable 2	8 bytes	Contents of VAR2
Real Variable 3	8 bytes	Contents of VAR3

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Real Variable 4	8 bytes	Contents of VAR4
Real Variable 5	8 bytes	Contents of VAR5
Real Variable 6	8 bytes	Contents of VAR6
Real Variable 7	8 bytes	Contents of VAR7
Real Variable 8	8 bytes	Contents of VAR8
Real Variable 9	8 bytes	Contents of VAR9
Real Variable 10	8 bytes	Contents of VAR10
Real Variable 11	8 bytes	Contents of VAR11
Real Variable 12	8 bytes	Contents of VAR12
Binary Variable 1	4 bytes	Contents of VARB1
Binary Variable 2	4 bytes	Contents of VARB2
Binary Variable 3	4 bytes	Contents of VARB3
Binary Variable 4	4 bytes	Contents of VARB4
Binary Variable 5	4 bytes	Contents of VARB5
Binary Variable 6	4 bytes	Contents of VARB6
Binary Variable 7	4 bytes	Contents of VARB7
Binary Variable 8	4 bytes	Contents of VARB8

Variable Mask Bit Information

Bit	Setting	Action
0	1	Enables setting VARI1
1	1	Enables setting VARI2
2	1	Enables setting VARI3
3	1	Enables setting VARI4
4	1	Enables setting VARI5
5	1	Enables setting VARI6
6	1	Enables setting VARI7
7	1	Enables setting VARI8
8	1	Enables setting VARI9
9	1	Enables setting VARI10
10	1	Enables setting VARI11
11	1	Enables setting VARI12
12	1	Enables setting VAR1
13	1	Enables setting VAR2
14	1	Enables setting VAR3
15	1	Enables setting VAR4
16	1	Enables setting VAR5
17	1	Enables setting VAR6
18	1	Enables setting VAR7
19	1	Enables setting VAR8
20	1	Enables setting VAR9
21	1	Enables setting VAR10
22	1	Enables setting VAR11
23	1	Enables setting VAR12
24	1	Enables setting VARB1
25	1	Enables setting VARB2
26	1	Enables setting VARB3
27	1	Enables setting VARB4
28	1	Enables setting VARB5
29	1	Enables setting VARB6
30	1	Enables setting VARB7

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31	1	Enables setting VARB8
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Action Mask Bit Information

Bit	Setting	Action
0	1	Enables normal fast status update
1	1	Enables expanded fast status update
2	0	Reserved
3	0	Reserved
4	0	Reserved
5	0	Reserved
6	0	Reserved
7	0	Reserved
8	0	Reserved
9	0	Reserved
10	0	Reserved
11	0	Reserved
12	0	Reserved
13	0	Reserved
14	0	Reserved
15	0	Reserved
16	0	Reserved
17	0	Reserved
18	0	Reserved
19	0	Reserved
20	0	Reserved
21	0	Reserved
22	0	Reserved
23	0	Reserved
24	0	Reserved
25	0	Reserved
26	0	Reserved
27	0	Reserved
28	0	Reserved
29	0	Reserved
30	0	Reserved
31	0	Reserved

B. Transmit Description

The port transmits 284 bytes per packet that contains data. The data is memory mapped, thus, 284 bytes are always sent per transmission. The port may transmit 380 bytes if the expanded status update is enabled. Data is transmitted when bit 0 or bit 1 of the action mask is set, when the NTSFS command is executed in the 6K or when an enabled alarm event occurs. Alarm events are enabled with the 6K command INTHW.

The commanded position and encoder positions are signed 32 bit numbers. The commanded velocity is an unsigned 32 bit number. The Status values are 32 bit numbers where each bit represents a state or mode setting. See the 6K Command Reference Guide for the bit assignments. The time frame counter is a running counter in 2.022 millisecond increments (if SYSPER4 is set, then the counter is in 4.044 millisecond increments). The command counter indicates the number of commands executed since

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power-up or reset outside of a program. The analog input values are in ADC counts represented as signed 16 bit words.

Transmit Packet (port 5001) Data Description:

Function	Size	Description
Update Mode	2 bytes	If non-zero, 6K will transmit fast status information at an interval specified in Port 5003.
Time Frame Counter	2 bytes	Free running counter in 2.022 or 4.044 ms
Axis 1 Commanded Position	4 bytes	See TPC command
Axis 2 Commanded Position	4 bytes	See TPC command
Axis 3 Commanded Position	4 bytes	See TPC command
Axis 4 Commanded Position	4 bytes	See TPC command
Axis 5 Commanded Position	4 bytes	See TPC command
Axis 6 Commanded Position	4 bytes	See TPC command
Axis 7 Commanded Position	4 bytes	See TPC command
Axis 8 Commanded Position	4 bytes	See TPC command
Axis 1 Encoder Position	4 bytes	See TPE command
Axis 2 Encoder Position	4 bytes	See TPE command
Axis 3 Encoder Position	4 bytes	See TPE command
Axis 4 Encoder Position	4 bytes	See TPE command
Axis 5 Encoder Position	4 bytes	See TPE command
Axis 6 Encoder Position	4 bytes	See TPE command
Axis 7 Encoder Position	4 bytes	See TPE command
Axis 8 Encoder Position	4 bytes	See TPE command
Axis 1 Commanded Velocity	4 bytes	See TVEL command
Axis 2 Commanded Velocity	4 bytes	See TVEL command
Axis 3 Commanded Velocity	4 bytes	See TVEL command
Axis 4 Commanded Velocity	4 bytes	See TVEL command
Axis 5 Commanded Velocity	4 bytes	See TVEL command
Axis 6 Commanded Velocity	4 bytes	See TVEL command
Axis 7 Commanded Velocity	4 bytes	See TVEL command
Axis 8 Commanded Velocity	4 bytes	See TVEL command
Axis 1 Axis Status	4 bytes	See TAS command
Axis 2 Axis Status	4 bytes	See TAS command
Axis 3 Axis Status	4 bytes	See TAS command
Axis 4 Axis Status	4 bytes	See TAS command
Axis 5 Axis Status	4 bytes	See TAS command
Axis 6 Axis Status	4 bytes	See TAS command
Axis 7 Axis Status	4 bytes	See TAS command
Axis 8 Axis Status	4 bytes	See TAS command
System Status	4 bytes	See TSS command
Error Status	4 bytes	See TER command
User Status	4 bytes	See TUS command

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Timer Value	4 bytes	See TTIM command
Limit Status	4 bytes	See TLIM command
Onboard Input Status	4 bytes	See TIN command
Brick 1 Input Status	4 bytes	See TIN command
Brick 2 Input Status	4 bytes	See TIN command
Brick 3 Input Status	4 bytes	See TIN command
Onboard Output Status	4 bytes	See TOUT command
Brick 1 Output Status	4 bytes	See TOUT command
Brick 2 Output Status	4 bytes	See TOUT command
Brick 3 Output Status	4 bytes	See TOUT command
Trigger Status	4 bytes	See TTRIG command
Analog Input Value	4 bytes	See TANI command
Binary Variable 1	4 bytes	VARB1
Binary Variable 2	4 bytes	VARB2
Binary Variable 3	4 bytes	VARB3
Binary Variable 4	4 bytes	VARB4
Binary Variable 5	4 bytes	VARB5
Binary Variable 6	4 bytes	VARB6
Binary Variable 7	4 bytes	VARB7
Binary Variable 8	4 bytes	VARB8
Binary Variable 9	4 bytes	VARB9
Binary Variable 10	4 bytes	VARB10
Integer Variable 1	4 bytes	VARI1
Integer Variable 2	4 bytes	VARI2
Integer Variable 3	4 bytes	VARI3
Integer Variable 4	4 bytes	VARI4
Integer Variable 5	4 bytes	VARI5
Integer Variable 6	4 bytes	VARI6
Integer Variable 7	4 bytes	VARI7
Integer Variable 8	4 bytes	VARI8
Integer Variable 9	4 bytes	VARI9
Integer Variable 10	4 bytes	VARI10
IP Address	4 bytes	6K IP Address
Command Counter	4 bytes	Total number of commands executed since power up.
*Real Variable 1	8 bytes	VAR1
*Real Variable 2	8 bytes	VAR2
*Real Variable 3	8 bytes	VAR3
*Real Variable 4	8 bytes	VAR4
*Real Variable 5	8 bytes	VAR5
*Real Variable 6	8 bytes	VAR6
*Real Variable 7	8 bytes	VAR7
*Real Variable 8	8 bytes	VAR8
*Real Variable 9	8 bytes	VAR9
*Real Variable 10	8 bytes	VAR10
*Real Variable 11	8 bytes	VAR11
*Real Variable 12	8 bytes	VAR12
Alarm Status	4 bytes	Bit status of alarm conditions (see bit descriptions below)

* Expanded status area must be enabled via port 5001.

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Alarm Status Bit Information

Bit	Setting	Action
0	1	User Software Alarm 1
1	1	User Software Alarm 2
2	1	User Software Alarm 3
3	1	User Software Alarm 4
4	1	User Software Alarm 5
5	1	User Software Alarm 6
6	1	User Software Alarm 7
7	1	User Software Alarm 8
8	1	User Software Alarm 9
9	1	User Software Alarm 10
10	1	User Software Alarm 11
11	1	User Software Alarm 12
12	1	Command Buffer Full
13	1	Enable Input Not Grounded
14	1	Program Complete
15	1	Drive Fault
16	1	Reserved
17	1	Reserved
18	1	Limit Hit
19	1	Stall Detected
20	1	Timer
21	1	Reserved
22	1	Alarm Input
23	1	Command Error
24	1	Motion Complete Axis 1
25	1	Motion Complete Axis 2
26	1	Motion Complete Axis 3
27	1	Motion Complete Axis 4
28	1	Motion Complete Axis 5
29	1	Motion Complete Axis 6
30	1	Motion Complete Axis 7
31	1	Motion Complete Axis 8

PORT 5002 (TCP/IP ASCII Commands)

A. Receive Description

This port receives standard 6K ASCII commands. Connecting to this port disables RS232 port 1. This connection acts as the 6K's communication port 1.

B. Transmit Description

This port transmits ASCII in response to a 6K command. The 6K communication settings (EOL, EOT, ERRLVL, etc) that frame the response are those of port 1.

PORT 5003 (UDP/IP Fast Status Update)

A. Receive Description

This port receives 4 bytes per packet to configure the status update interval. The data is memory mapped, thus, 4 bytes must be sent per transmission. The first two bytes set the update mode, if nonzero then the next two bytes set the rate in milliseconds that the status data will be automatically transmitted.

Receive Packet (port 5003) Data Description:

Function	Size	Description
Update mode	2 bytes	Sets the mode to update fast status information if non-zero.
Update interval	2 bytes	Sets the fast status update interval in milliseconds.

B. Transmit Description

The port transmits 280 bytes per packet which contains data. The data is memory mapped, thus, 280 bytes are always sent per transmission. The port may transmit 376 bytes if the expanded status update is enabled. Data is transmitted at the time interval set above.

The commanded position and encoder positions are signed 32 bit numbers. The commanded velocity is an unsigned 32 bit number. The Status values are 32 bit numbers where each bit represents a state or mode setting. See the 6K Command Reference Guide for the bit assignments. The time frame counter is a running counter in 2.022 millisecond increments (if SYSPER4 is set, then the counter is in 4.044 millisecond increments). The command counter indicates the number of commands executed since power-up or reset outside of a program. The analog input values are in ADC counts represented as signed 16 bit words.

Transmit Packet (port 5003) Data Description:

Function	Size	Description
Update Mode	2 bytes	If non-zero, 6K will transmit fast status information at an interval specified in Port 5003.
Time Frame Counter	2 bytes	Free running counter in 2.022 or 4.044 ms
Axis 1 Commanded Position	4 bytes	See TPC command
Axis 2 Commanded Position	4 bytes	See TPC command
Axis 3 Commanded Position	4 bytes	See TPC command
Axis 4 Commanded Position	4 bytes	See TPC command
Axis 5 Commanded Position	4 bytes	See TPC command

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Axis 6 Commanded Position	4 bytes	See TPC command
Axis 7 Commanded Position	4 bytes	See TPC command
Axis 8 Commanded Position	4 bytes	See TPC command
Axis 1 Encoder Position	4 bytes	See TPE command
Axis 2 Encoder Position	4 bytes	See TPE command
Axis 3 Encoder Position	4 bytes	See TPE command
Axis 4 Encoder Position	4 bytes	See TPE command
Axis 5 Encoder Position	4 bytes	See TPE command
Axis 6 Encoder Position	4 bytes	See TPE command
Axis 7 Encoder Position	4 bytes	See TPE command
Axis 8 Encoder Position	4 bytes	See TPE command
Axis 1 Commanded Velocity	4 bytes	See TVEL command
Axis 2 Commanded Velocity	4 bytes	See TVEL command
Axis 3 Commanded Velocity	4 bytes	See TVEL command
Axis 4 Commanded Velocity	4 bytes	See TVEL command
Axis 5 Commanded Velocity	4 bytes	See TVEL command
Axis 6 Commanded Velocity	4 bytes	See TVEL command
Axis 7 Commanded Velocity	4 bytes	See TVEL command
Axis 8 Commanded Velocity	4 bytes	See TVEL command
Axis 1 Axis Status	4 bytes	See TAS command
Axis 2 Axis Status	4 bytes	See TAS command
Axis 3 Axis Status	4 bytes	See TAS command
Axis 4 Axis Status	4 bytes	See TAS command
Axis 5 Axis Status	4 bytes	See TAS command
Axis 6 Axis Status	4 bytes	See TAS command
Axis 7 Axis Status	4 bytes	See TAS command
Axis 8 Axis Status	4 bytes	See TAS command
System Status	4 bytes	See TSS command
Error Status	4 bytes	See TER command
User Status	4 bytes	See TUS command
Timer Value	4 bytes	See TTIM command
Limit Status	4 bytes	See TLIM command
Onboard Input Status	4 bytes	See TIN command
Brick 1 Input Status	4 bytes	See TIN command
Brick 2 Input Status	4 bytes	See TIN command
Brick 3 Input Status	4 bytes	See TIN command
Onboard Output Status	4 bytes	See TOUT command
Brick 1 Output Status	4 bytes	See TOUT command
Brick 2 Output Status	4 bytes	See TOUT command
Brick 3 Output Status	4 bytes	See TOUT command
Trigger Status	4 bytes	See TTRIG command
Analog Input Value	4 bytes	See TANI command
Binary Variable 1	4 bytes	VARB1
Binary Variable 2	4 bytes	VARB2
Binary Variable 3	4 bytes	VARB3
Binary Variable 4	4 bytes	VARB4
Binary Variable 5	4 bytes	VARB5
Binary Variable 6	4 bytes	VARB6
Binary Variable 7	4 bytes	VARB7
Binary Variable 8	4 bytes	VARB8
Binary Variable 9	4 bytes	VARB9

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Binary Variable 10	4 bytes	VARB10
Integer Variable 1	4 bytes	VARI1
Integer Variable 2	4 bytes	VARI2
Integer Variable 3	4 bytes	VARI3
Integer Variable 4	4 bytes	VARI4
Integer Variable 5	4 bytes	VARI5
Integer Variable 6	4 bytes	VARI6
Integer Variable 7	4 bytes	VARI7
Integer Variable 8	4 bytes	VARI8
Integer Variable 9	4 bytes	VARI9
Integer Variable 10	4 bytes	VARI10
IP Address	4 bytes	6K IP Address
Command Counter	4 bytes	Total number of commands executed since power up.
*Real Variable 1	8 bytes	VAR1
*Real Variable 2	8 bytes	VAR2
*Real Variable 3	8 bytes	VAR3
*Real Variable 4	8 bytes	VAR4
*Real Variable 5	8 bytes	VAR5
*Real Variable 6	8 bytes	VAR6
*Real Variable 7	8 bytes	VAR7
*Real Variable 8	8 bytes	VAR8
*Real Variable 9	8 bytes	VAR9
*Real Variable 10	8 bytes	VAR10
*Real Variable 11	8 bytes	VAR11
*Real Variable 12	8 bytes	VAR12

* Expanded status area must be enabled via port 5001.

PORT 5004 (TCP/IP Watchdog)

A. Receive Description

This port receives 12 bytes per packet to configure the watchdog timer. The first two bytes configures the time interval in seconds and the second two bytes configures the number of retries a packet is to be transmitted during the time interval.

Receive Packet (port 5004) Data Description:

Function	Size	Description
Watchdog Timer	2 bytes	Time interval in seconds for watchdog.
Watchdog Ticker	2 bytes	Number of retries per time interval before watchdog times out.
Reserved	8 bytes	Reserved for future use and should be set to zero.

B. Transmit Description

The port immediately echoes the Receive Packet Data for Port 5004.

Transmit Packet (port 5004) Data Description:

Function	Size	Description
Watchdog Timer	2 bytes	Time interval in seconds for watchdog.
Watchdog Ticker	2 bytes	Number of retries per time interval before watchdog times out.
Reserved	8 bytes	Reserved. These will be all zero.