PNI – CommBoard (RS-232, RS-485)

General Description

The CommBoard is a communication interface designed to connect various PNI sensor modules to a host system that uses a standard serial interface, such as a PC. It is typically used as a prototyping and evaluation tool for PNI's line of compass and magnetometer modules. The PNI CommBoard is also used for production when the host system requires a higher level serial protocol to interface to the PNI sensor modules. The first version of the PNI CommBoard features a user selectable RS-232 or RS-485 interface to the host system, and SPI interface to the sensor module. The CommBoard developer kit comes with software for the PC that has a Graphical User Interface (GUI) to control every aspect of the CommBoard and any PNI module that is attached to it.

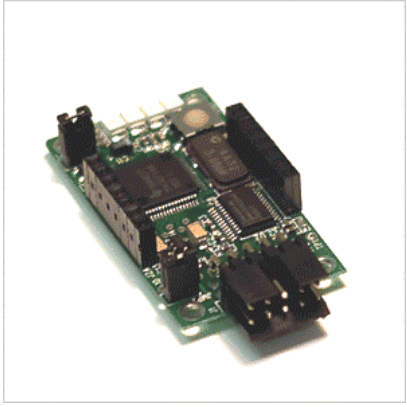
In the future different interfaces may be made available as customer needs are identified. Please contact PNI for support with your custom interface high-volume opportunity.

Features

- RS-232 and RS-485 interfaces for connection with PCs or other serial interface systems.
- Reprogrammable firmware via JTAG connector
- GUI control software available from PNI, either as part of the developer kit or via the web.
- Small size: 53 x 25 x 11 mm.
- Built-in support for PNI MicroMag and V2Xe sensor modules, as well as several future products.
- Voltage regulator converts 6-12VDC to 3 VDC to power the sensor modules.
- Minimal code changes required when upgrading from PNI's TCM-2 line of tilt compensated magnetometer compass modules.

Applications

- Fast compass and/or magnetometer prototyping.
- New product evaluation.
- Education; school projects.
- Any legacy compass application that has an RS-232 interface but needs the performance of the new PNI products.
- Production applications where standards based protocols are preferred over SPI.



……*Ordering Information*

NAME	PART NUMBER	Package
CommBoard	11867	Bulk

Functional Diagram appears at end of data sheet

For more information, please call PNI Corporation direct at (707) 566-2260, email: sales@pnicorp.com, or visit PNI's website at http://www.pnicorp.com

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Table of Contents

Absolute Maximum Ratings

SYMBOL	PARAMETER	MIN	MAX	UNITS	NOTES
V_{DD}	DC Supply Voltage	-0.3	16	VDC	
V_{IN}	Input Pin Voltage (CTS, RxD)	-25	25	VDC	To GND
	Input Pin Voltage (TxD, RTS)	-13.2	13.2		
	Input Pin Voltage (D+, D-)				
T_{STRG}	Storage Temperature	-40	85	°C	

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Characteristics

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
OPERATING CHARACTERISTICS						
Current - Standby	Low Power Mode (No Module Loaded)	LPM0 (1)		14.4		mA RMS
		LPM1 (2)		7.0		
		LPM2 (3)		5.4		
RS-232 RECEIVER INPUTS (CTS, RxD)						
Input Threshold – Low			0.6			VDC
Input Threshold – High					2.0	
RS-232 TRANSMITTER OUTPUT (TxD)						
Output Voltage Swing	Both transmitter outputs loaded with 3kΩ to GND		±5	±5.4		VDC
Output Resistance	V_{CC} = V+ = V- = 0 Output = +2V		300	10M		Ω
Output Short-Circuit Current	Output = GND			±30	±60	mA

(1) **LMP0** is when the unit is in normal operating mode with the LEDs enabled.
(2) **LMP1** is when the unit is in normal operating mode with the LEDs disabled.
(3) **LMP2** is when the unit is in a "sleep" mode and will need to be "awakened" via the CTS (Wake Up) line.

Characteristics (continued)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
RS-485 TRANSCEIVER SIGNALS (D-, D+)					
Input Differential Threshold		-200		-50	mVDC
Differential Output Voltage	R = 27Ω	1.5			VDC
Change in Magnitude of Differential Output Voltage for Complementary Output States	R = 27Ω or 50Ω	-0.2		0.2	
Common-Mode Output Voltage				3	
Change in Magnitude of Common-Mode Output Voltage for Complementary Output States				0.2	
Output Short-Circuit Current	V_Y or V_Z = +12V to –7V			±250	mA

Serial Pin Descriptions

PIN	NAME	FUNCTION	NOTES
1	TxD	RS-232 Transmitter Outputs	Transmitted Data
2	Reserved		Reserved
3	CTS	RS-232 Receiver Inputs	Wake Up
4	RxD		Received Data
5	D-	RS-485 Transceiver Signals	**Inverting** RS-485 signal.
6	D+		**Non-inverting** RS-485 signal.
7	N/C		
8	GND	Ground	
9	VCC	Supply voltage	5 – 12 VDC
10	GND	Ground	

RS-232, RS-485 Jumper Settings

Location of the jumpers can be found by going to the Assembly View section.

Jumper Configuration	Mode
JMP1 Installed (1)	RS-232
JMP1 Removed	RS-485
JMP2 Installed (2)	RS-485; 120 Ω line termination
JMP2 Removed	RS-485; No line termination

(1) The processor only checks the status of JMP1 at power-up. If the position of the jumper needs to be changed, either cycle power or press the RESET switch after the change has been made.
(2) JMP2 needs to be installed on the **LAST** unit of the network. All other units need to have JMP2 removed for proper RS-485 operation.

Hardware Modes

The CommBoard provides a serial interface to PNI's sensor modules. Its purpose is to translate a serial command from a host system into the appropriate SPI command. If the sensor module does not support the command, it will return an appropriate error code. Otherwise, it will return the associated data. See applicable PNI module data sheet for specific information on communication and control using the SPI interface.

- **RS-232 Mode** uses software handshaking to communicate
  - Xon = ^Q = 0x11 (OK to send data)
  - Xoff = ^S = 0x13 (Stop sending data)

- **RS-485 Mode** is only Half-Duplex
  - The "go" command is not allowed since Half-Duplex implies queried responses only
  - The CommBoard acts as a Slave when the JMP1 is removed.
  - **Standard Output Mode (sdo=t)**

    Example: !FF0021$$C194.74X-106.00Y-403.00Z98.00:E200*1E
    !DdSs<rscs>${data}*<dcs><es>

!	RS-485 data delimiter
Dd	Destination address
Ss	Source address
<rscs>	RS-485 checksum based on NMEA checksum method on 1st 5 chars. "!DdSs"
$	Start data delimiter
{data}	Selected data output
*	End data delimiter
<dcs>	NMEA checksum between "$" and "*"
<es>	End of message based on eol variable <cr>or <lf> or <cr><lf>

Standard Data Output Modes

PNI Standard Output Mode (sdo=t)

Example: $C194.74X-106.00Y-403.00Z98.00:E200*1E
${data}*<dcs><es>

$	Start data delimiter
{data}	Selected data output
*	End data delimiter
<dcs>	NMEA checksum between "$" and "*"
<es>	End of message based on eol variable <cr>or <lf> or <cr><lf>

NMEA Output Mode (National Marine Electronics Association) (sdo=n)

Example: $HCHDM,71.33,M*2F<es>

$	Start data delimiter
HC	Heading Compass (Magnetic)
HDM	Heading Magnetic
,71.33	Heading Degrees
,M	Magnetic (Data type)
*	End data delimiter
<es>	End of message based on eol variable <cr>or <lf> or <cr><lf>

RAW Output Mode (sdo=r)

Example: $raw,C172.81X53Y-420Z0*6E
$raw,{data}*<dcs><es>

$	Start data delimiter
{data}	Selected data output
*	End data delimiter
<dcs>	NMEA checksum between “$” and “*”
<es>	End of message based on eol variable <cr>or <lf> or <cr><lf>

Command Line Interface

The Command Line interface allows the user to use a simple terminal program to communicate with the CommBoard. The Command Line Interface also allows applications written in Assembly, Basic or C to communicate with the CommBoard via RS-232 or RS-485.

Command Sequence

The sequence of command line events would be:

1. User types in command on terminal program: **cmd?<es>**
2. Module processes command
3. Module sends reply back to user
    a. If no error: **$cmdreply*<dcs><es>**
    b. If error: **$cmdreply:Exxx*<dcs><es>**

Command Table Notation

Command Symbol	Response Symbol	Description
'?'		Indicates query only command or variable
'='		Indicates assign only command or variable
<aq>		Use '?' for query or '=<val>' for assign
<es>		Ending sequence <cr> or <lf> or <cr><lf>
	'$'	Start of checksum data
	'!'	RS-485 address follows
	':'	If Error occurs, :Ennn
	'*'	End of Checksum data
	<dcs>	Data Checksum; between '$' and '*' (1)
	<er>	Start of data
n	n	Usually a lower case 'n' will represent a digit (0-9)
n.n	n.n	Represents a decimal value (positive or negative)
x	x	Usually a lower case 'x' will represent a hex digit (0-F)
xx	xx	Represents a Uint8
xxxx	xxxx	Represents a Uint16
xxxxxxxx	xxxxxxxx	Represents a Uint32

(1) The NMEA XOR checksum method for the values between '$' and '*'.

Example Command Notation

Example: m<aq><es>

- Could be interpreted as a query: **m?<es>**
- Could be interpreted as an assign: **m=<val><es>**

Example Response Notation

Example: $m=<val>*<dcs><er>

Ending Sequence

The CommBoard will accept either <cr> or <lf> or <cr><lf> as an end of line (eol) indicator.

EOL (End Of Line) Response

The CommBoard will send a response to the user in the chosen EOL format.

- If (eol=cr) Send ("\r")
- If (eol=lf) Send ("\n")
- If (eol=crlf) Send ("\r\n")

Error Codes

Error codes are a bitmap to the error that has occurred. Errors are sent when an error condition has occurred.

Example: $C194.74X-106.00Y-403.00Z98.00:E200*1E
$Cnnn.nnXnnn.nnYnnn.nnZnnn.nn:Exxx*<dcs><er>

- Exxx: "xxx" are hex values between 0-F
- The built-in error command to parse error messages, **error efff<cr><lf>** will list the error codes.

- E800 - EEPROM1 error
- E400 - EEPROM2 error
- E200 - Module not calibrated
- E080 - Internal error
- E040 - Command parameter invalid
- E020 - Command/data mode conflict
- E010 - Command invalid or unavailable
- E004 - Magnetometer out of range
- E002 - Inclinometer out of range
- E001 - Magnetic distortion alarm (1)

(1) Indicates that the magnetic field has changed significantly since the last calibration. See specific module data sheet for parameter range.

Action Commands

Help Menu: *help or ?*

Description	Instructs the CommBoard to display the Help Menu
Command Format	help<es> or ?<es>
Response Format	Menu Data
Default Value	None
Syntax	None
Notes	None

Continuous Output: *go*

Description	Instructs the CommBoard to enter Continuous Output mode. The CommBoard will begin sampling sensors at the rate specified by the '**pollfreq**' command.
Command Format	go<es>
Response Format	${selectedData}*<dcs><er>
Default Value	None
Syntax	None
Notes	Stopped using the '**h**' command

Halt Continuous Output: *h*

Description	Instructs the CommBoard to exit the Continuous Output mode
Command Format	h<es> - if **halt=d** h - if **halt=e**
Response Format	$h*<dcs><er>
Default Value	None
Syntax	None
Notes	None

Factory Settings Restore: *factory*

Description	Restores the unit to the factory default configuration
Command Format	factory<es>
Response Format	$factory*<dcs><er>
Default Value	None
Syntax	None
Notes	None

Module Information: *info?*

Description	Displays the CommBoard software version, module type and module software version
Command Format	info?<es>
Response Format	$info,data*<dcs> - CommBoard $info,data*<dcs> - Module
Default Value	None
Syntax	None
Notes	None

Module Id: *id?*

Description	Displays the module type
Command Format	id?<es>
Response Format	$id=xx*<dcs><er>
Default Value	None
Syntax	xx = 00 None 01 MicroMag (X sensor only) 02 MicroMag (Y sensor only) 03 MicroMag (X & Y sensors) 10 V2Xe
Notes	If the MicroMag responds with either a 01 or 02 contact PNI Corporation.

Query Commands

Compass Update: *c?*

Description	Retrieves the compass heading
Command Format	c?<es>
Response Format	${hdg}*<dcs><er>
Default Value	None
Syntax	hdg = 0 to 359.99 - if **uc=d** hdg = 0 to 6399 - if **uc=m**
Notes	Based upon the setting of the '**sdo**' command and the '**uc**' command.

Magnetometer Update: *m?*

Description	Retrieves the magnetometer values X, Y and Z
Command Format	m?<es>
Response Format	$Xn.nYn.nZn.n*<dcs><er>
Default Value	None
Syntax	xn.n = -32767.9 to 32767.9
Notes	Z sensor output is not available on all modules. Refer to specific module data sheet for more information.

Inclinometer Update: *i?*

Description	Retrieves the inclinometer values
Command Format	i?<es>
Response Format	$Pn.nRn.n*<dcs><er>
Default Value	None
Syntax	P = Pitch R = Roll
Notes	Inclinometer output is not available on all modules. Refer to specific module data sheet for more information.

Temperature Update: *t?*

Description	Retrieves the temperature value
Command Format	t?<es>
Response Format	$raw,Txxxx*<dcs><er> - if **sdo=r** $Tn.n*<dcs><er> - if **sdo=t**
Default Value	None
Syntax	raw, Txxxx = the raw temperature sensor output Tn.n = the calibrated temperature sensor output
Notes	Outputs based on setting of '**ut**' command. Temperature output is not available on all modules. Refer to specific module data sheet for more information.

Query Commands (continued)

Single Sample Update: *s?*

Description	Retrieves user selected calibrated information
Command Format	s?<es>
Response Format	${selectedData}*<dcs><er>
Default Value	None
Syntax	selectedData = varies according to user settings
Notes	Based upon the settings of the various Configuration Commands

X Axis Sensor Update: *x?*

Description	Retrieves only the X axis magnetometer values
Command Format	x?<es>
Response Format	$Xn.n*<dcs><er>
Default Value	None
Syntax	n.n = -32767.9 to 32767.9
Notes	None

Y Axis Sensor Update: *y?*

Description	Retrieves only the Y axis magnetometer values
Command Format	y?<es>
Response Format	$Yn.n*<dcs><er>
Default Value	None
Syntax	n.n = -32767.9 to 32767.9
Notes	None

Z Axis Sensor Update: *z?*

Description	Retrieves only the Z axis magnetometer values
Command Format	z?<es>
Response Format	$Zn.n*<dcs><er>
Default Value	None
Syntax	n.n = -32767.9 to 32767.9
Notes	Z sensor output is not available on all modules. Refer to specific module data sheet for more information.

Single Raw Sample Update: *sr?*

Description	Retrieves user selected uncalibrated data
Command Format	sr?<es>
Response Format	${selectedRawData}*<dcs><er>
Default Value	None
Syntax	selectedRawData = varies according to user settings
Notes	Based upon the settings of the various Configuration Commands

Query Commands (continued)

Error Code List: *error n*

Description	Retrieves a description of the error code entered
Command Format	error x<es>
Response Format	$error x: (description)*<dcs><er>
Default Value	None
Syntax	x = the error number returned by the CommBoard following the “E”
Notes	See Error Code Table for code descriptions

Configuration Commands

Echo Characters Enable: *echo*

Description	Enables character echo
Command Format	echo<aq><es>
Response Format	$echo={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	echo?<es>
Notes	None

End of Line Output Enable: *eol*

Description	Sets the type of End of Line output
Command Format	eol<aq><es>
Response Format	$eol={value}*<dcs><er>
Default Value	crlf
Syntax	cr = output cr after line lf = output lf after line crlf = output crlf after line
Status Request	eol?<es>
Notes	None

Compass Data Enable: *ec*

Description	Enables the compass data output
Command Format	ec<aq><es>
Response Format	$ec={value}*<dcs><er>
Default Value	e
Syntax	e = enabled d = disabled
Status Request	ec?<es>
Notes	None

Configuration Commands (continued)

Pitch Data Enable: *ep*

Description	Enables the pitch data output
Command Format	ep<aq><es>
Response Format	$ep={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	ep?<es>
Notes	Pitch output is not available on all modules. Refer to specific module data sheet for more information.

Roll Data Enable: *er*

Description	Enables the roll data output
Command Format	er<aq><es>
Response Format	$er={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	er?<es>
Notes	Roll output is not available on all modules. Refer to specific module data sheet for more information.

Temperature Data Enable: *et*

Description	Enables the temperature data output
Command Format	et<aq><es>
Response Format	$et={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	et?<es>
Notes	Temperature output is not available on all modules. Refer to specific module data sheet for more information.

Magnetometer Data Enable: *em*

Description	Enables the magnetometer data output
Command Format	em<aq><es>
Response Format	$em={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	em?<es>
Notes	None

Configuration Commands (continued)

X Axis Data Enable: *ex*

Description	Enables the X axis data output
Command Format	ex<aq><es>
Response Format	$ex={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	ex?<es>
Notes	None

Y Axis Data Enable: *ey*

Description	Enables the Y axis data output
Command Format	ey<aq><es>
Response Format	$ey={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	ey?<es>
Notes	None

Z Axis Data Enable: *ez*

Description	Enables the Z axis data output
Command Format	ez<aq><es>
Response Format	$ez={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	ez?<es>
Notes	Z sensor output is not available on all modules. Refer to specific module data sheet for more information.

Single Character Halt Enable: *halt*

Description	Enables sending a single **'h'** to cancel the **'go'** mode
Command Format	halt<aq><es>
Response Format	$halt={value}*<dcs><er>
Default Value	e
Syntax	e = enabled; (h) d = disabled; (h<es>)
Status Request	halt?<es>
Notes	None

Configuration Commands (continued)

Baud Rate: *b*

Description	Sets the baud rate of the CommBoard
Command Format	b<aq><es>
Response Format	$b={value}*<dcs><er>
Default Value	5
Syntax	0 = 300 4 = 4800 8 = 57600 1 = 600 5 = 9600 2 = 1200 6 = 19200 3 = 2400 7 = 38400
Status Request	b?<es>
Notes	None

Compass Units: *uc*

Description	Sets the compass output to either degrees or mils
Command Format	uc<aq><es>
Response Format	$uc={value}*<dcs><er>
Default Value	d
Syntax	d = degrees m = mils
Status Request	uc?<es>
Notes	None

Inclinometer Units: *ui*

Description	Sets the inclinometer output to either degrees or mils
Command Format	ui<aq><es>
Response Format	$ui={value}*<dcs><er>
Default Value	d
Syntax	d = degrees m = mils
Status Request	ui?<es>
Notes	Inclinometer output is not available on all modules. Refer to specific module data sheet for more information.

Thermometer Units: *ut*

Description	Sets the thermometer output to either degrees Fahrenheit or Celsius
Command Format	ut<aq><es>
Response Format	$ut={value}*<dcs><er>
Default Value	f
Syntax	f = Fahrenheit c = Celsius
Status Request	ut?<es>
Notes	Thermometer output is not available on all modules. Refer to specific module data sheet for more information.

Configuration Commands (continued)

Select Data Output Format: sdo

Description	Sets the data output format to either PNI standard, NMEA or RAW
Command Format	sdo<aq><es>
Response Format	$sdo={value}*<dcs><er>
Default Value	t
Syntax	t = PNI standard format n = NMEA 0183 compatible format r = raw output format
Status Request	sdo?<es>
Notes	See Standard Output Modes section for more information

Select Magnetometer Output: ma

Description	Selects either Corrected or Uncorrected magnetometer output
Command Format	ma<aq><es>
Response Format	$ma={value}*<dcs><er>
Default Value	u
Syntax	c = corrected u = uncorrected
Status Request	ma?<es>
Notes	This option is not available on all modules. Refer to specific module data sheet for more information.

Low Power Mode: lpm

Description	Selects the Low Power Mode for the CommBoard
Command Format	lpm<aq><es>
Response Format	$lpm={value}*<dcs><er>
Default Value	0
Syntax	0 = no conservation 1 = LEDs off 2 = ultra low power; RTS required to wake-up
Status Request	lpm?<es>
Notes	See the Operating Characteristics Table for more information

RS-485 Slave Address: rs485

Description	Sets the slave address for the CommBoard in RS-485 mode
Command Format	rs485<aq><es>
Response Format	$rs485=xx*<dcs><er>
Default Value	00
Syntax	xx = 00 to 7F
Status Request	rs485?<es>
Notes	None

Configuration Commands (continued)

Polling Frequency: *pollfreq*

Description	Sets the sample polling frequency of the '**go**' command
Command Format	pollfreq<aq><es>
Response Format	$pollfreq=nn*<dcs><er>
Default Value	8
Syntax	nn = 0 = 1 sample / 2 sec. = 1-16 = value in Hz
Status Request	pollfreq?<es>
Notes	None

Temperature Update Frequency: *tempfreq*

Description	Sets the update rate of the temperature sensor in samples per hour
Command Format	tempfreq<aq><es>
Response Format	$tempfreq=nn*<dcs><er>
Default Value	1
Syntax	nn = value in samples / hour.
Status Request	tempfreq?<es>
Notes	This option is not available on all modules. Refer to specific module data sheet for more information.

Module Commands

Save Settings: *save*

Description	Use to save the module settings
Command Format	save<aq><es>
Response Format	$save*<dcs><er>
Default Value	None
Syntax	None
Notes	None

Unpolled Calibration Enable: *upcal*

Description	Enable the upolled calibration
Command Format	upcal<es>
Response Format	$upcal={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	upcal?<es>
Notes	See Calibration section for more information

Module Commands (continued)

Multi-polled Calibration Enable: mpcal

Description	Enable the multi-polled calibration
Command Format	mpcal<es>
Response Format	$mpcal={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	mpcal?<es>
Notes	See Calibration section for more information

Clear Calibration Data: cc

Description	Used to clear the previous calibration information
Command Format	cc<es>
Response Format	$cc*<dcs><er>
Default Value	None
Syntax	None
Notes	None

Last Calibration Score: lc?

Description	Retrieves the last calibration score
Command Format	lc?<es>
Response Format	$HnVnMn.n*<dcs><er>
Default Value	None
Syntax	“n” is equal to the score value Hn = 0-9 Vn = 0-9 Mn.n > 0
Notes	This option is based upon the calibration score of the PNI Corp. TCM2 module. This option is not available on all modules. Refer to specific module data sheet for more information.

North Mode: sn

Description	Used to set either True or Magnetic North
Command Format	sn<aq><es>
Response Format	$sn={value}*<dcs><er>
Default Value	m
Syntax	t = true m = magnetic
Status Request	sn?<es>
Notes	None

Module Commands (continued)

Inclinometer Clip Value: *cclip*

Description	Used to set a clipping value for the maximum positive and negative angle of the inclinometer. When the inclinometer angle exceeds this value, it is clipped to the set value along with an out of range flag.
Command Format	cclip<aq><es>
Response Format	$cclip=nn.n*<dcs><er>
Default Value	0
Syntax	nn.n = 0 to maximum tilt value allowed by the module
Status Request	cclip?<es>
Notes	This option is not available on all modules. Refer to specific module data sheet for more information.

Declination Value: *mag_dec*

Description	Sets the declination offset for a reading of True North
Command Format	mag_dec<aq><es>
Response Format	$mag_dec=nnn*<dcs><er>
Default Value	0
Syntax	nnn = ±180 if **uc=d** ; then mag_dec is in degrees nnn = ±3200 if **uc=m** ; then mag_dec is in mils
Status Request	mag_dec?<es>
Notes	Based upon the setting of the **'uc'** command. See the Declination section for more information.

Digital Damping Enable: *damping*

Description	Enables digital damping of the compass heading output
Command Format	damping<aq><es>
Response Format	$damping={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	damping?<es>
Notes	Refer to specific module data sheet for more information.

Digital Damping Sample Size: *dampsize*

Description	Sets the value for the digital damping of the compass heading output
Command Format	dampsize<aq><es>
Response Format	$dampsize=nn*<dcs><er>
Default Value	1
Syntax	nn = 1 to 20
Status Request	dampsize?<es>
Notes	Refer to specific module data sheet for more information.

Module Commands (continued)

Xflip Enable: *xflip*

Description	Enables the X axis orientation change in the module
Command Format	xflip<aq><es>
Response Format	$xflip={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	xflip?<es>
Notes	None

Yflip Enable: *yflip*

Description	Enables the Y axis orientation change in the module
Command Format	yflip<aq><es>
Response Format	$yflip={value}*<dcs><er>
Default Value	d
Syntax	e = enabled d = disabled
Status Request	yflip?<es>
Notes	None

ASIC Period Select: *ps*

Description	Sets the value for the ASIC period select
Command Format	ps<aq><es>
Response Format	$ps=n*<dcs><es>
Default Value	5
Syntax	n = 0 = /32 = 1 = /64 = 2 = /128 = 3 = /256 = 4 = /512 = 5 = /1024 = 6 = /2048 = 7 = /4096
Status Request	sp?<es>
Notes	The lowest setting (/32) will give the fastest response but the lowest resolution. The highest setting (/4096) will give the slowest response but the highest resolution. Refer to the specific module data sheet for response times and maximum setting allowed.

SPI Interface to Sensor Module

SPI Pin Descriptions

PIN	NAME	FUNCTION	NOTES
1	SCLK	Serial Clock output for SPI port	
2	MISO	Serial data input (Master In Slave Out)	
3	MOSI	Serial data output (Master Out Slave In)	
4	SSNOT	Active low Chip select for SPI port	
5	DRDY	Data Ready input	
6	SYNC	SYNC output	
7	GND	Ground	
8	GIO0	Reserved I/O	
9	GIO1	Reserved I/O	
10	GIO2	Reserved I/O	
11	GIO3	Reserved I/O	
12	VDD	Supply Voltage	3VDC Regulated
13	VCC	Unregulated CommBoard input Supply Voltage	
14	GND	Ground	

SPI Module Interface

All access to the sensor module by the CommBoard is through a synchronous serial interface using hardware handshaking, compliant with the Motorola SPI protocol. The interface consists of six signals: SCLK, MOSI, MISO, SSNOT, SYNC and DRDY.

SPI Port Pin Descriptions

- **MOSI –** Master Out, Slave In for the Module SPI port.
- **SSNOT –** Slave Select for the Module SPI port. SSNOT must remain low until the command response is clocked out.
- **SCLK –** Serial Clock input for SPI port.
- **MISO –** Master In, Slave Out for the Module SPI port.

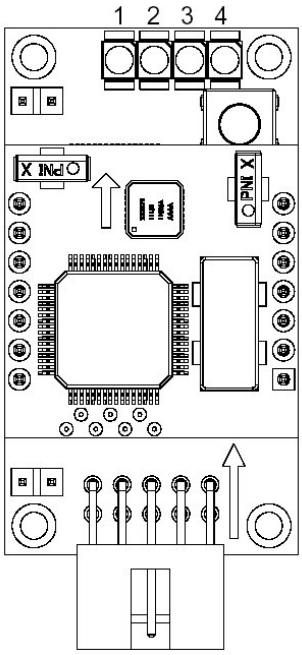
SPI Hardware Handshaking Pin Descriptions

- **SYNC –** SYNC is usually low. SYNC must be toggled from low-high-low.
- **DRDY –** Data Ready. The module returns DRDY. DRDY is low after a SYNC; after a command has been received and the data is ready, DRDY is raised.

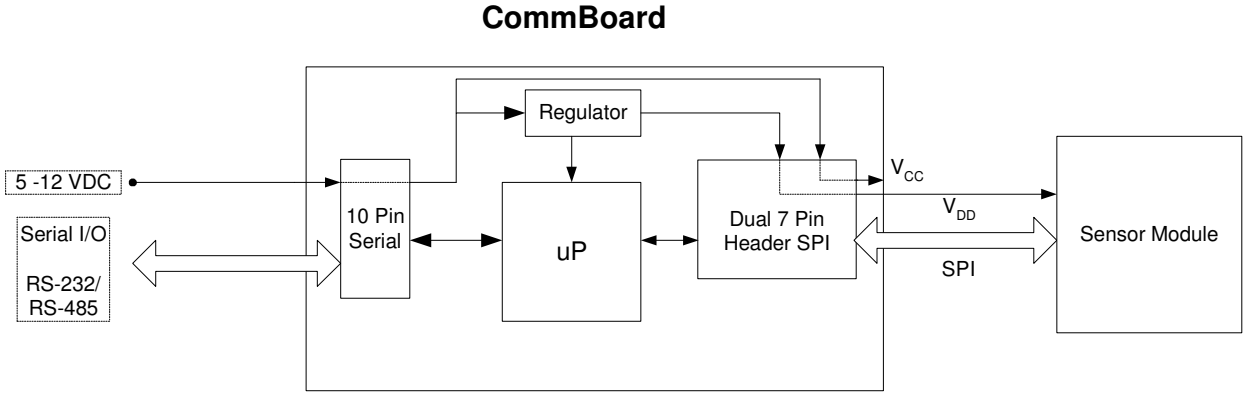
Note: *See applicable PNI module data sheet for specific information on communication and control using the SPI interface.*

LED Status Indicators

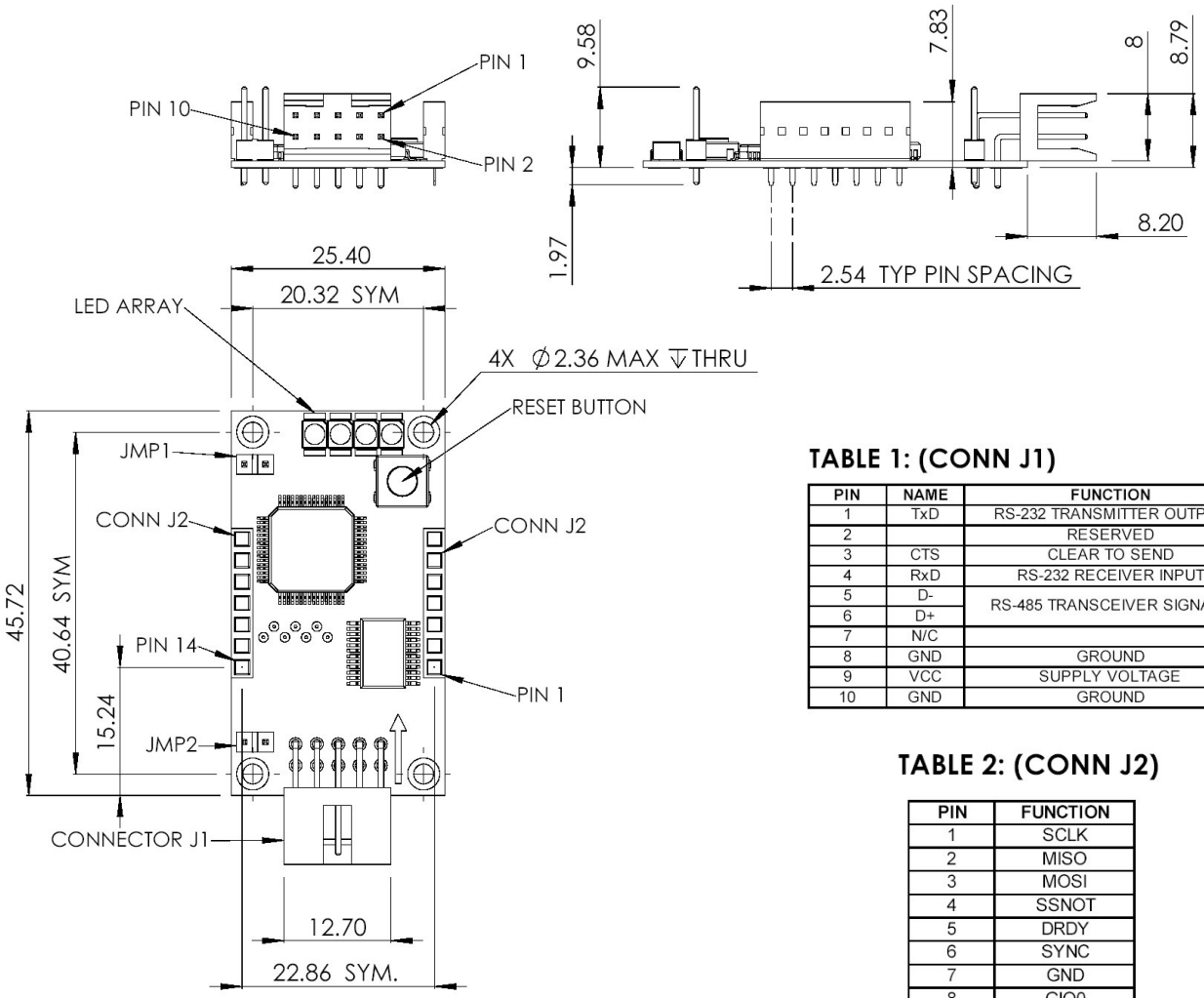
1. RS-232 RxD; Toggles every time characters are received.
2. RS-232 TxD; Toggles every time characters are transmitted.
3. Activity Indicator
4. Activity Indicator



Communication Block Diagram



Assembly View



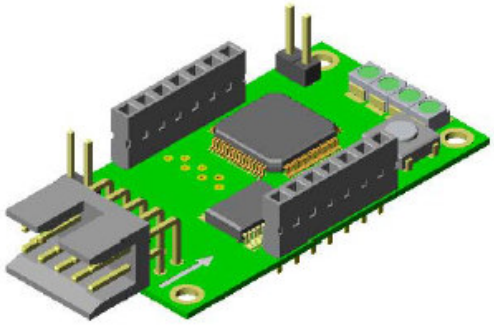


TABLE 1: (CONN J1)

PIN	NAME	FUNCTION
1	TxD	RS-232 TRANSMITTER OUTPUT
2		RESERVED
3	CTS	CLEAR TO SEND
4	RxD	RS-232 RECEIVER INPUT
5	D-	RS-485 TRANSCEIVER SIGNALS
6	D+	
7	N/C	
8	GND	GROUND
9	VCC	SUPPLY VOLTAGE
10	GND	GROUND

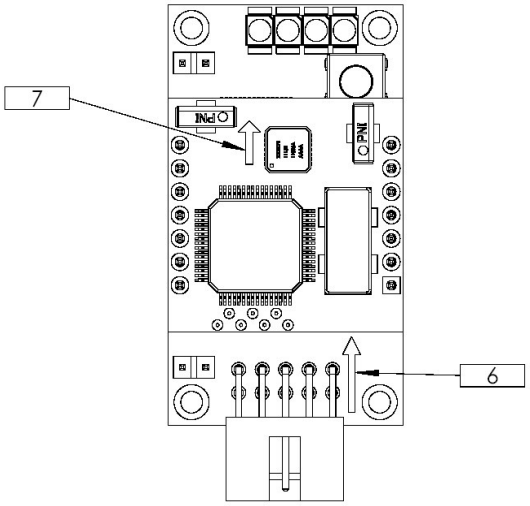
TABLE 2: (CONN J2)

PIN	FUNCTION
1	SCLK
2	MISO
3	MOSI
4	SSNOT
5	DRDY
6	SYNC
7	GND
8	GIO0
9	GIO1
10	GIO2
11	GIO3
12	VDD
13	VCC
14	GND

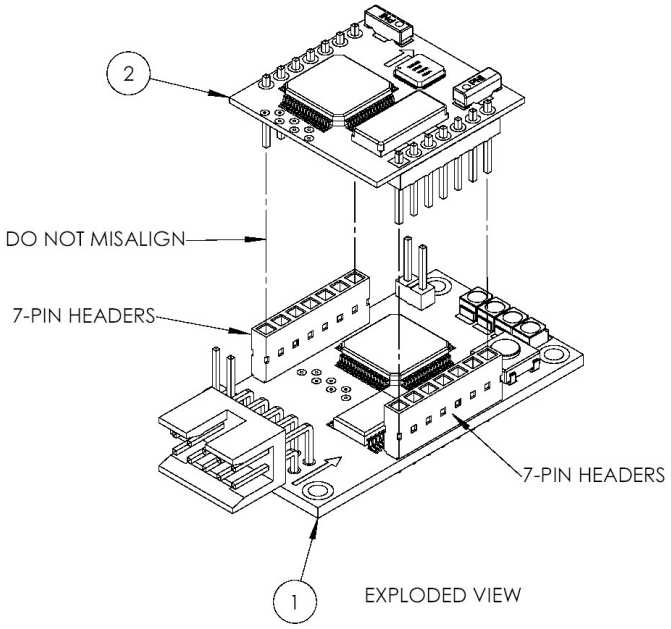
TABLE 3: (JUMPERS)

JUMPER CONFIGURATION	MODE
JMP1 INSTALLED	RS 232
JMP1 REMOVED	RS 485
JMP2 INSTALLED	RS 485 TERMINATION
JMP2 REMOVED	RS 485 NO TERMINATION

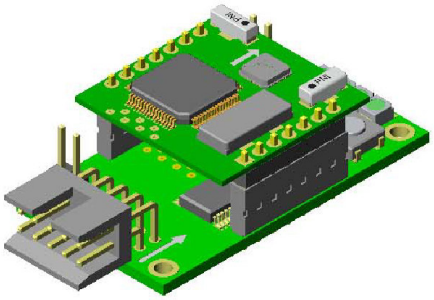
Assembly View (continued)



NOTES (UNLESS OTHERWISE STATED):
1. THIS DOCUMENT PERTAINS TO PNI CORP. PART NO. 11588
2. UNITS: ALL UNITS IN METRIC, MILLIMETERS.
3. TOLERANCES: ± 0.1 mm.
4. TABLE 1 PROVIDES PINOUT DEFINITIONS FOR CONNECTOR J1.
5. TABLE 2 PROVIDES PINOUT DEFINITIONS FOR CONNECTOR J2:
6. THE ARROW ON THE COMM BOARD IS DEFINED AS POINTING IN THE "OUTWARD" DIRECTION.
7. DURING INSTALLATION, ENSURE THAT THE WHITE SLIKSCREENED ARROWS ON BOTH THE STACKED BOARD AND THE COMM BOARD ARE POINTING IN THE SAME DIRECTION ("OUTWARD"). DO NOT MISALIGN OR PLUG THE STACKED BOARD INTO THE 7-PIN HEADERS BACKWARDS.



EXPLODED VIEW

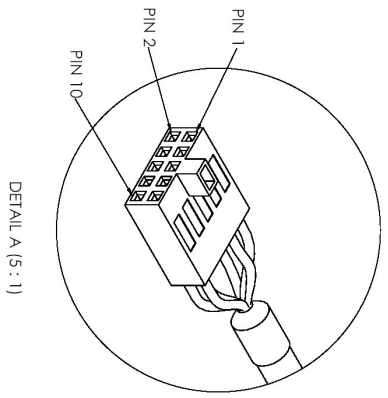


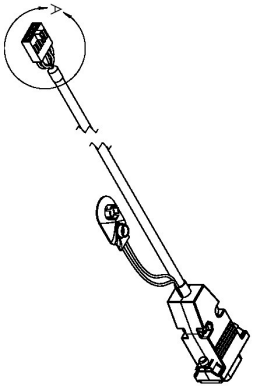
ASSEMBLED VIEW

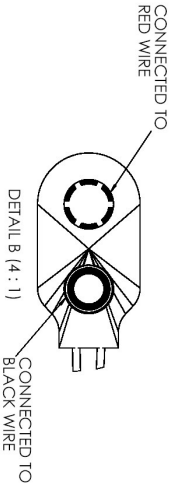
ITEM NO.	DESCRIPTION
1	COMM BOARD
2	INTERCHANGEABLE SENSOR MODULE

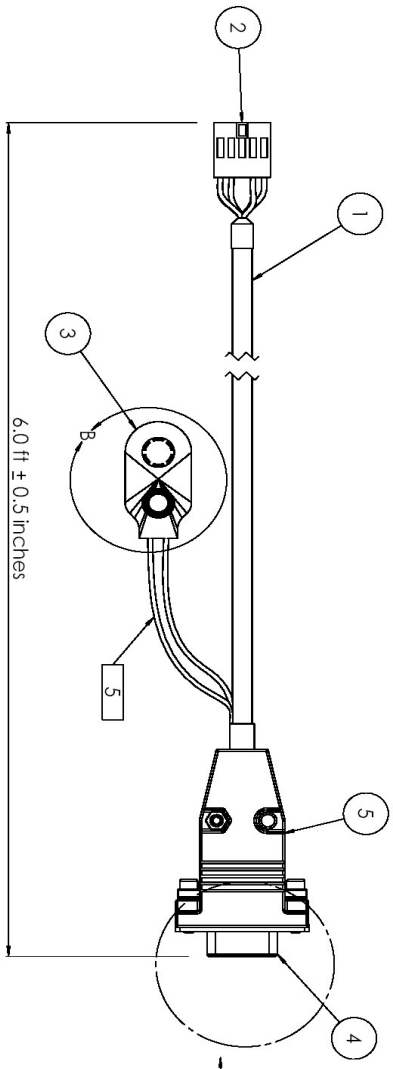
CommBoard RS-232 Cable

PNI – CommBoard (RS-232, RS-485)









NOTES (UNLESS OTHERWISE SPECIFIED):
1. UNITS: ALL UNITS IN STANDARD U.S. (INCHES)
2. WIRE SPECIFICATIONS FOR DUAL INLINE CONNECTOR DEPICTED IN **DETAIL A** ARE PROVIDED IN THE FOLLOWING TABLE 1:

TABLE 1: (DUAL IN-LINE CONNECTOR)

PIN	WIRE	DESCRIPTION
1	YELLOW	TXD (RS-232)
2	-	-
3	WHITE	CTS
4	BLUE	RXD (RS-232)
5	-	-
6	-	-
7	-	-
8	GREEN	GND
9	RED	Vsupply 5-12 VDC
10	BLACK	GND

3. PARTS AND MATERIAL SPECIFICATIONS PROVIDED IN THE FOLLOWING TABLE 2:

TABLE 2

ITEM NO.	PNI P/N	DESCRIPTION	APPROVED VENDOR	VENDOR P/N
1	10357	10 CONDUCTOR 24AWG STRANDED (7 X 32)	BELDEN	9540
2	11772	CRIMP HOUSING	FCI	65846-010
3	11710	STRAP BATTERY 9VDC I-STYLE 4" LEAD	KEYSTONE	2238
4	11712	D-SUB 9 CONNECTOR, FEMALE	JIC	DB-09S-UL
5	11711	METAL HOOD U-SHAPED	JIC	HD-09MTL-V
6	11773	CONNECTOR CRIMPS	FCI	482510-000

4. TABLE 3 PROVIDES THE PINOUT FOR THE DB9 FEMALE CONNECTOR.
5. THESE 9VDC POWER CABLES TO BE 3.0 ± 0.2 INCHES IN LENGTH.

TABLE 3: (DB9 CONNECTOR)

PIN	WIRE	DESCRIPTION
1	NC	-
2	YELLOW	TXD (RS-232)
3	BLUE	RXD (RS-232)
4	NC	-
5	GREEN	GND
6	NC	-
7	WHITE	CTS
8	NC	-
9	NC	-