



SDI RMYoung Wind Monitor

Wind Sensor with Smart SDI-12
Interface

User Manual



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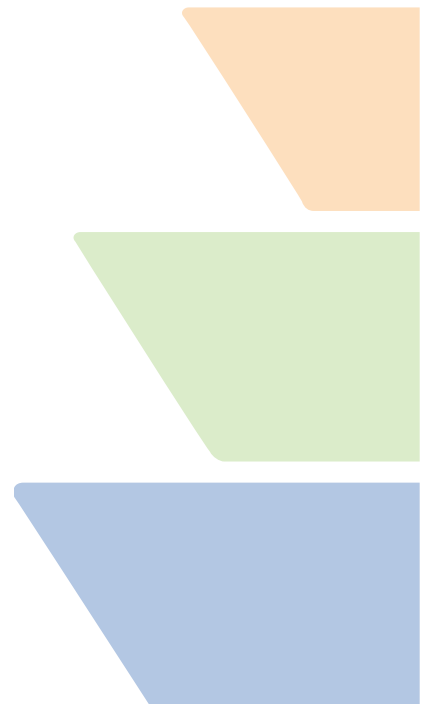




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Chapter 1 Operation

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1.1 Naming

“SDI RMYoung Wind Monitor” is a bit of a mouthful for repeated use. For convenience , we refer to this product as “SDI-RMY” throughout this manual.

1.2 General description

The FTS SDI-RMY is an R.M.Young Model 05103 wind-speed/wind-direction sensor fitted with a smart SDI-12 interface. The SDI-12 interface module is “smart” because in addition to measuring the R.M.Young sensor output, the it also provides wind averaging and peak detection features. The module fits inside the connector box of a standard R.M.Young sensor, so its external form is unchanged, except for the new SDI-12 cable emerging from the box.



Figure 1-1: SDI-RMY sensor package

Figure 1-2 below shows the cable connections inside the connector box:

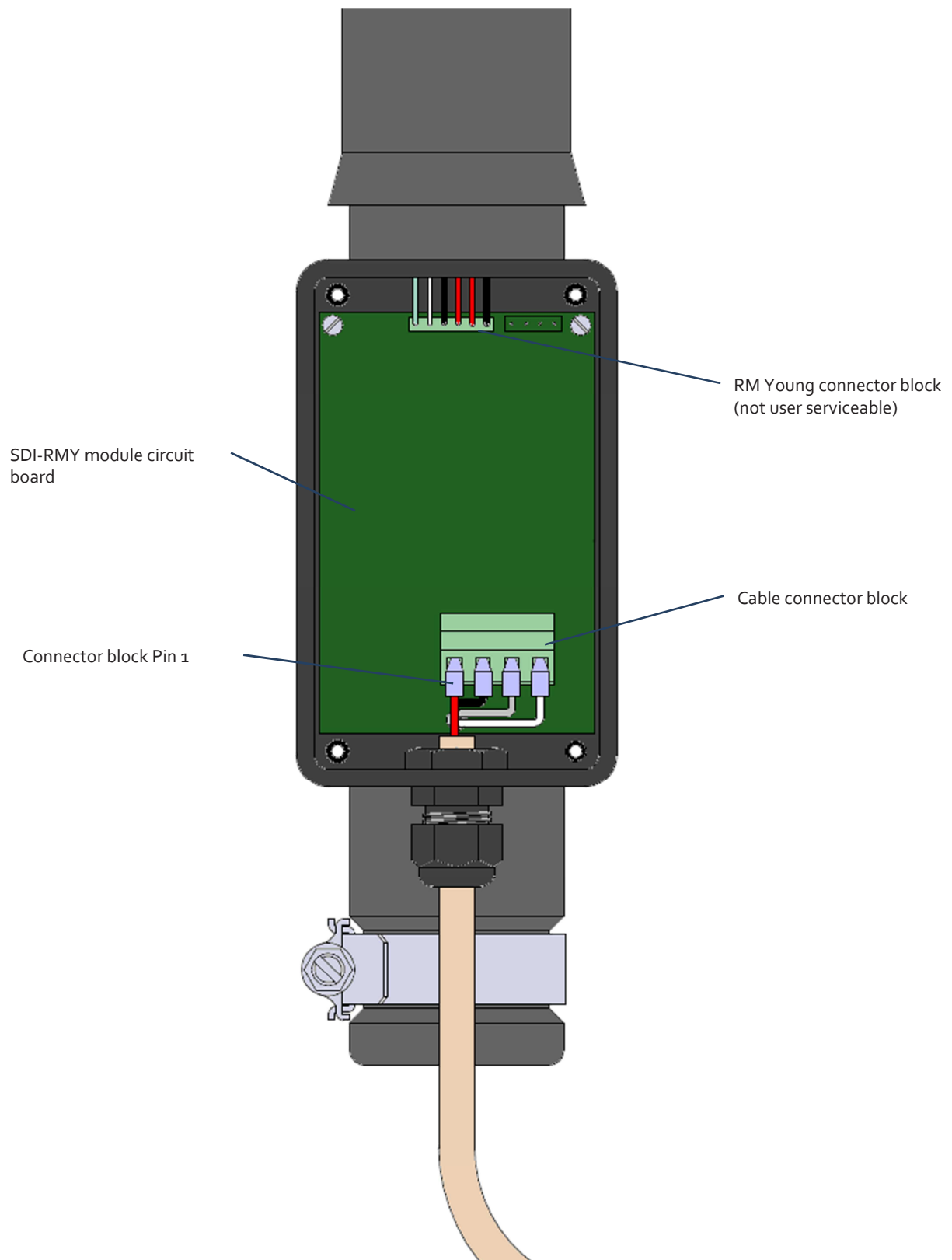


Figure 1-2: SDI-RMY connector box connections

1.3 Cabling and connectors

1.3.1 Cabling options

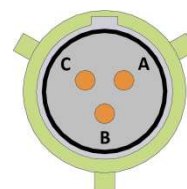
The SDI-RMY is offered with three cabling options:

Model code	Cabling	Connector
SDI-WS-RMY-1	50 ft standard cable	FTS standard military style bayonet connector
SDI-WS-RMY-2	50 ft armoured cable	FTS standard military style bayonet connector
SDI-WS-RMY-3	50 ft standard cable	flying leads – no connector

1.3.2 FTS standard connector

Cable wire colour coding and FTS standard connector¹ pinouts are shown in the table and diagram below:

Wire colour	Pin ¹	Function
Red	A	+12 V dc Power
White	B	Data
Black	C	Ground



1.3.3 Direct PC board connections

The SDI-Wind module may be connected directly on the circuit board using screw terminals, for users who require custom cabling.

Pin	Function
1	+12 V dc Power
2	Ground
3	Chassis Ground
4	Data

1.3.4 Module – sensor connector

The connection between SDI-Wind module and R.M. Young connector P1 is not designed to be user-serviceable. The pinout is given for reference.

Pin	Function
1	Wind Direction Wiper
2	Wind Direction Excitation
3	Ground
4	Ground
5	Windspeed Input (AC)
6	Windspeed GND

¹ Waterproof military-style bayonet connector 851-06JC8-3AP50; FTS part number 520-83AP; compatible with FTS Axiom dataloggers.

1.4 *Configuration*

The SDI-RMY interface module is shipped with default address 0 (unless shipped as part of an integrated FTS system). Refer to the Command section of this manual for instructions on changing SDI-RMY module settings.

1.5 *Calibration and maintenance*

The SDI-RMY interface module does not normally require recalibration. However, if anomalous readings are observed, the module should be checked and returned to the factory for recalibration if necessary. Field maintenance required by the SDI-RMY module is limited to a periodic check of the sensor cable and connectors for deterioration. Please contact FTS technical support for information on return of the module for calibration or if the unit ceases to operate properly (refer to the inside cover page for contact information).

Please contact FTS technical support (see manual front pages) if the unit ceases to operate properly.



Chapter 2 SDI commands

Commands implemented in the SDI-RMY interface module conform to SDI-12 version 1.3. Commands can be broken into four categories; SDI general commands, SDI configuration commands, SDI data commands, and SDI factory commands. SDI-12 commands are sent from the datalogger or a controller using the appropriate software.

NOTE: FTS Axiom dataloggers have a built-in SDI-RMY configuration graphical user interface which eliminates the need for low-level command programming (refer to the appropriate FTS datalogger manual for more information).

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2.1 Notation for SDI commands

In the end, SDI commands are just strings of characters sent to the SDI device. The format of those strings is important, of course, and to specify the format of SDI commands we use different typefaces. All commands (and the replies from the device) are represented in a monospaced font, **thus**. Different parts of a command are represented with variants on this text format.

Item	Meaning	Text representation
Command literal	Part of a command that must be reproduced literally as it appears;	X
Command parameter	Part of a command that must be filled in with an appropriate value	<i>data</i>

2.2 Commands recognized by SDI-RMY

The table below provides a quick reference to the commands recognized by the sensor. For details on these commands, see the following sections.

Command name	Command code
General Commands	
Address Query	?!
Acknowledge Active	a!
Change Address	aAb!
Send Identification	aI!
Configuration Commands	
Factory Default Settings	aX set fds!
Units Configuration	aX set units data! aX get units!
Averaging Configuration – Wind Speed Sampling Interval	aX set wssi data! aX get wssi!
Averaging Configuration – Wind Speed Number of Samples	aX set wsns data! aX get wsns!
Peak detection configuration	aX set peak data! aX get peak!
Data Commands	
Start Measurement	aM!, aM1!, aM2!, aM3!, aM4!, aM5!, aM6!
Start Concurrent Measurement	aC!, aC1!, aC2!, aC3!, aC4!, aC5!, aC6!
Send Data	aD0
Start Verification	aV!
Factory Commands	
Serial Number	aX g ~fsn~!
Date of Manufacture	aX g ~dom~!
Bootloader Version	aX g bv!
PCB Version	aX g pcb!

2.3 General SDI commands

General SDI commands are used for housekeeping issues such as device address configuration, device identification and confirmation of device communications. General SDI-12 version 1.3 commands are as follows.

2.3.1 Address Query

This command requests the address of the SDI sensor.

C/R	String	Note
Cmd	?!	request the (single) device on this bus to report its address
Resp	0	the sensor is configured for address 0 Note: only one SDI device can be connected to the bus when using this command

2.3.2 Acknowledge Active

This command queries whether a sensor is present on the SDI bus at the specified address.

C/R	String	Note
Cmd	0!	request the device at address 0 to confirm it is active
Resp	0	a device is active at address 0

2.3.3 Change Address

This command changes a sensor's SDI address.

C/R	String	Note
Cmd	0A3!	change the address of the device at SDI address 0 to 3
Resp	3	device address (response confirms change)

2.3.4 Send Identification

This command requests detailed identification information from the addressed sensor.

C/R	String	Note
Cmd	3I!	
Resp	313FTS-----WTMP-v134567	<div> <div>3</div> <div>13</div> <div>FTS</div> <div>WTMP</div> <div>-v1</div> <div>34567</div> </div> <div> <div>device SDI address</div> <div>compatible with SDI-12 version 1.3</div> <div>manufacturer's identifier</div> <div>sensor model</div> <div>version 1 of sensor firmware</div> <div>sensor serial number</div> </div>

2.4 SDI configuration commands

2.4.1 Introduction

Configuration commands are for configuring the SDI-RMY sensor's measurement units, and the behavior of its averaging and peak detection algorithms. SDI-RMY configuration commands follow the protocol for Extended SDI commands.

The general form of an extended SDI command is shown below. The SDI-RMY has only two types of extended commands, configuration set and configuration get:

Command type	Command format	Note
general	<i>aX cmd option data!</i>	
configuration set	<i>aX set option data!</i>	responds only with SDI address of device
configuration get	<i>aX get option!</i>	responds with data; data type and format depends on option

The parts of the command must each be separated by either a space, a colon or a slash ('/'); in this document we always use spaces.

The parts of these commands are explained in the table below. For details, see specific commands below.

Command part	Meaning
<i>a</i>	SDI address of unit
X	SDI extended command (literal - must be uppercase)
<i>cmd</i>	set or get
<i>option</i>	see specific commands below
<i>data</i>	see specific commands below
!	SDI command delimiter (literal)

2.4.2 Factory default settings

This command option sets the SDI-RMY sensor to its factory default configuration.

There is only the set version of this command.

option

fds

data

-none-

Example

C/R	String	Note
Cmd	3X set fds!	set the sensor configuration to the factory default settings

C/R	String	Note
Resp	3	device address (confirms receipt of command)

SDI-RMY factory default settings are:

Wind Speed Unit	m/s
Base Sampling Period	0.25 s
Wind Speed Sampling Interval	1 s
Wind Speed Averaging	600
Wind Speed Peak Window	5 s

2.4.3 Units configuration

This command option is used to configure the SDI-RMY sensor's wind speed measurement output unit.

option

units

data

The possible values of *data* are:

Value	Unit
m/s	meters per second
knots	knots
mph	miles per hour
kph	kilometers per hour

Examples

C/R	String	Note
Cmd	3X set units kph!	set wind speed units to kilometres per hour
Resp	3	(device address) response confirms receipt of command
Cmd	3X get units!	get device wind speed units
Resp	3kph	3 device address kph wind speed units are kilometres per hour

2.4.4 Averaging configuration

The averaging feature uses a moving average algorithm. Every sample interval a new measurement sample is taken and stored, and an old sample discarded. The combination of sample interval and number of samples determines the overall averaging time. If an hour-long average is required, then a sample interval of 5 seconds at 720 samples per average should be set.

Two averaging types are supported: Scalar and Vector. If scalar averaging is used the WS average is simple the sum of the WS divided by N. To calculate the scalar WD average the direction is decomposed into N-S and E-W components, the N-S components are summed and divided by N as are the E-W components. The components are then converted to degrees to get the average direction.

If vector averaging is used the wind speed and direction are first converted to N-S and E-W component vectors. The N-S components are summed and divided by N as are the E-W components to get an average vector which can then be converted to polar speed and direction.

The maximum number of samples that can be averaged is 720. The shortest sample interval supported is 0.25 sec. The duration of the average equals: sample interval * number of samples.

option and data

Value of <i>option</i>	Meaning	Value of <i>data</i>
wssi	wind speed sample interval	sample interval (range: 0.25 – 10)
wsns	wind speed number of samples in average	number of samples (range: 1 – 720)

Examples

C/R	String	Note
Cmd	3X set wssi 5!	set wind speed sample interval to 5 seconds
Resp	3	
Cmd	3X get wssi!	get wind speed sample interval
Resp	35	3 device address 5 wind speed sample interval is 5 seconds
Cmd	3X set wsns 300!	set wind speed number of samples to 300
Resp	3	
Cmd	3X get wsns!	get wind speed number of samples
Resp	3300	3 device address 300 wind speed number of samples is 300

2.4.5 Peak detection configuration

This command option is used to configure the SDI-RMY sensor's peak wind measurement algorithm.

The peak detection algorithm calculates a moving average of wind speed over a specified time period, before computing the peak value. The averaging sample period is fixed to 0.25 seconds, and the overall averaging duration determined by the peak command setting (0.25 - 10 seconds). If a duration of 0.25 seconds is configured, no averaging will be performed, and any single measured wind speed sample might be registered as peak value.

option

peak

data

peak averaging interval (number; range: 0.25 – 10)

Examples

C/R	String	Note
Cmd	3X set peak 3.5!	set peak averaging interval to 3.5 seconds sensor will continuously average wind speed over 5 seconds to determine peak.

C/R	String	Note
Resp	3	device address
Cmd	3X get peak!	set peak averaging interval to 5 seconds sensor will continuously average wind speed over 5 seconds to determine peak.
Resp	33.5	3 device address 3.5 WS sample interval is 3.5 seconds

2.5 SDI data commands

SDI data commands request data from the sensor.

2.5.1 Measurement commands

These commands trigger a measurement on the addressed sensor. The sensor does not immediately return measurement data; instead the sensor begins a measurement and returns the time delay before the measurement is complete as well as the number of data points that will be returned when measurement data is requested. The data is requested using a subsequent Send Data command, which must be sent after the time delay has expired.

2.5.1.1 Start Measurement

Using a Start Measurement command (“M” command), only one sensor at a time can be performing a measurement.

2.5.1.2 Start Concurrent Measurement

The Start Concurrent Measurement command (“C” command) allows a sensor to take a measurement while other SDI sensors are also taking measurements. The Start Concurrent Measurement Command operates in the same manner and returns the same information as the Start Measurement command (see below).

2.5.1.3 Start Continuous Measurement

The Start Continuous Measurement command (“R” command) is not supported.

2.5.1.4 Cyclic redundancy checks

A cyclic redundancy check (CRC) request can be added to any of the measurement (M), concurrent measurement (C), or continuous measurement (R) commands by appending a C to the command code (e.g., **aMC!** instead of **aM!** or **aCC2!** instead of **ac2!**). Requesting a CRC will cause the device to append a CRC code to the data returned by a Send Data command.

2.5.1.5 Measurement command reference

Command	Command formats	Data request returns
Average Measurement	aM!	Scalar Average Speed
	aMC!	Scalar Average Direction
	aC!	Vector Average Speed
	aCC!	Vector Average Direction
		Status
		Average Count
		Units Code
Instantaneous Measurement		CRC (if requested)
	aM1!	Speed
	aMC1!	Direction
	aC1!	Status
	aCC1!	Units Code
		CRC (if requested)

Command	Command formats	Data request returns
Peak Measurement – Read Only	aM2! aMC2! aC2! aCC2!	Peak 1 Speed Peak 1 Direction Peak 1 Status Peak 2 Speed Peak 2 Direction Peak 2 Status Units Code CRC (if requested)
Peak Measurement – Read and Reset Peak 1	aM3! aMC3! aC3! aCC3!	same as Read Only
Peak Measurement – Read and Reset Peak 2	aM4! aMC4! aC4! aCC4!	same as Read Only
Peak Measurement – Read and Reset Peak 1& Peak 2	aM5! aMC5! aC5! aCC5!	same as Read Only
Raw Measurements	aM6! aMC6! aC6! aCC6!	Frequency Resistance CRC (if requested)

Status codes

Status code	Meaning
0	Measurement OK
1	Wind direction is suspect
2	RESERVED FOR FUTURE USE (Wind speed is suspect)
3	RESERVED FOR FUTURE USE (Both speed and direction are suspect)
128	Averaging algorithm is still in startup phase. The averaged result has been calculated with less samples than configured.

Units codes

Units Code	Meaning
0	m/s
1	kilometers per hour
2	miles per hour
3	knots

Examples

See next section.

2.5.2 Send data

This command requests the data generated by the preceding Measurement (M or C) command. An **ad0!** command is always the first command sent to retrieve the data. If additional data needs to be read, then an **ad1!** command is sent, then and **ad2!** etc. etc., up to **ad9!**. Since the SDI-RMY returns at most 7 values with few characters each, only an **ad0!** command is ever required with it.

Examples

Note that all returned data values, including counts and status values, include a + or – sign.

C/R	String	Note
Cmd	3M!	start an average measurement on the device at address 3
Resp	30007	3 device address 000 measurement delay is zero 7 number of data points returned
Cmd	3D0!	request data from previous measurement command
Resp	3+0.0+227.3+0.0+0.0+128+20+2	3 device address +0.0 scalar average speed +227.3 scalar average direction +0.0 vector average speed +0.0 vector average direction +128 status (algorithm in startup mode) +20 average count +2 units code (miles per hour)
Cmd	3M1!	start an instantaneous measurement on the device at address 3
Resp	30004	3 device address 000 measurement delay is zero 4 number of data points returned
Cmd	3D0!	request data from previous measurement command
Resp	0+4.1+211.5+0+2	0 device address +4.1 instantaneous speed +211.5 instantaneous direction +0 measurement status (OK) +2 units code (miles per hour)
Cmd	3M2!	start an average measurement on the device at address 3
Resp	30007	3 device address 000 measurement delay is zero 7 number of data points returned
Cmd	3D0!	request data from previous measurement command

C/R	String	Note
Resp	3+22.7+204.5+0+21.9+215.0+0+2	3 device address
		+22.7 peak 1 speed
		+204.5 peak 1 direction
		+0 peak 1 status (measurement OK)
		+21.9 peak 2 speed
		+215.0 peak 2 direction
		+0 peak 2 status (measurement OK)
		+2 units code (miles per hour)

2.6 SDI factory commands

The SDI Factory Commands are for SDI-RMY sensor housekeeping. Factory SDI-12 commands for the module are shown below. The SDI Factory Commands follow the protocol for SDI Extended commands

Command	Command format
extended command (general)	<i>aX cmd option data!</i>
Serial Number	<i>aX g ~fsn~!</i>
Date of Manufacture	<i>aX g ~dom~!</i>
Bootloader Version	<i>aX g bv!</i>
PCB Version	<i>aX g pcb!</i>

2.6.1 Serial number

This command returns the SDI-RMY Sensor's factory issued serial number. The number reported is the same as that shown on label on the SDI-RMY module.

Example

C/R	String	Note
Cmd	3X g ~fsn~!	
Resp	354345	3 sensor SDI address
		54345 serial number

2.6.2 Date of manufacture

This command is used to read the SDI-RMY module's manufacture date.

Example

C/R	String	Note
Cmd	3X g ~dom~!	
Resp	32008081416	3 module SDI address
		2008 year
		08 month
		14 day
		16 hour (24-hour clock)
		(response means Aug 14, 2008 at 4 pm)

2.6.3 Bootloader version

This command returns the SDI-RMY module's low-level bootloader version (bv). Note that the bootloader version is different than the module's firmware version reported by the "Send Identification" command.

Example

C/R	String	Note	
Cmd	3X g bv!		
Resp	33	3	sensor SDI address
		3	bootloader version

2.6.4 PCB version

This command returns the SDI-RMY module's printed circuit board (pcb) hardware version. This command returns the hardware revision version to allow the SDI-RMY's firmware to determine what circuitry is present. The command does not return the actual pcb revision number (the number shown on the pcb silkscreen). For example, the PC board could be a revision 3 circuit board but the circuitry on the PCB may only be hardware version 2. In this case this command would return 2 as the hardware version.

Example

C/R	String	Note	
Cmd	3X g pcb!		
Resp	32	3	sensor SDI address
		2	printed circuit board version



Chapter 3 Installation

This chapter outlines the necessary steps for mounting the R.M. Young wind sensor on an FTS Trileg Tower, an MPF tower, as well as for Handar upgrades.

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3.1 Trileg Tower installation

For new installations the mast should already be in a lowered position.

For upgrades or servicing, remove 4" pinning bolt from U-shaped bracket and gently lower mast. Allow mast to ride in a horizontal plane supported by its safety cable. In an ideal situation, the tower mast will be aligned to true north.

3.1.1 R.M. Young mount

Insert R.M. Young mount into the end of the top mast section. Align bolt holes, and insert and tighten the bolts. Slide the orientation ring onto mount as indicated. Ensure key on ring points perfectly upwards, and snug the hose clamp but DO NOT tighten yet.

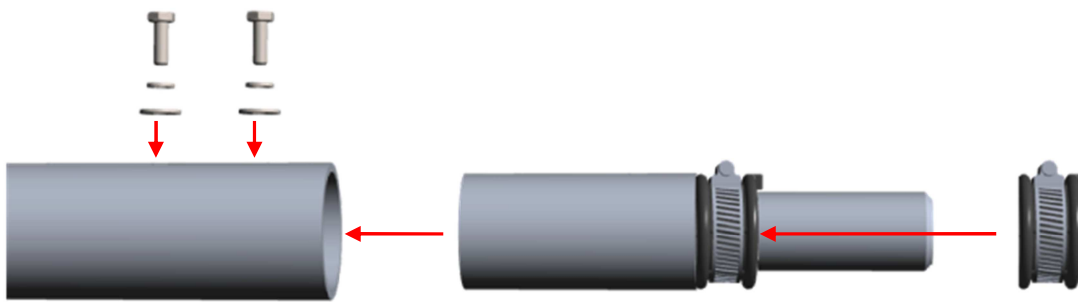


Figure 3-1: R.M. Young mount installation

If upgrading wind sensors on the Trileg Tower to the R.M. Young, two holes must be drilled at the top end of the mast for fastening the R.M. Young mount. See diagram below for detailed measurements for holes. If RVT antenna is mounted at the end of the mast, it must be moved and mounted on one of the tower post legs.

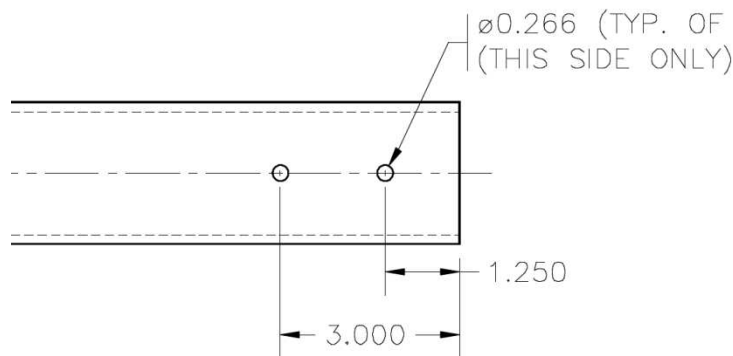


Figure 3-2: Hole measurements for Trileg Tower upgrades to R.M. Young sensor

3.1.2 R.M. Young orientation

Slide the north arrow into the mount as indicated, and ensure the key lines up with the notch in the north arrow. Raise the mast, and using a compass determine if the arrow is pointing to true north.

If the tower mast is not properly aligned, the arrow will not be oriented pointing towards true north. If this is the case, lower the mast and adjust the orientation ring key to position the arrow pointing as close to true north as possible. Raise the mast and check the north alignment again. If necessary, repeat and adjust appropriately. After orientation is complete, tighten the hose clamp and remove the north arrow.



Figure 3-3: R.M. Young orientation

3.1.3 Mount the R.M. Young

Install the propeller onto the shaft, and ensure that the serial numbers on the propeller are facing into the wind. Secure with plastic nut provided. Slide the R.M. Young onto the mount and align the notch at the instrument base with orientation ring key. Snug the instrument hose clamp. Raise the mast to check to ensure that the sensor points to true north.

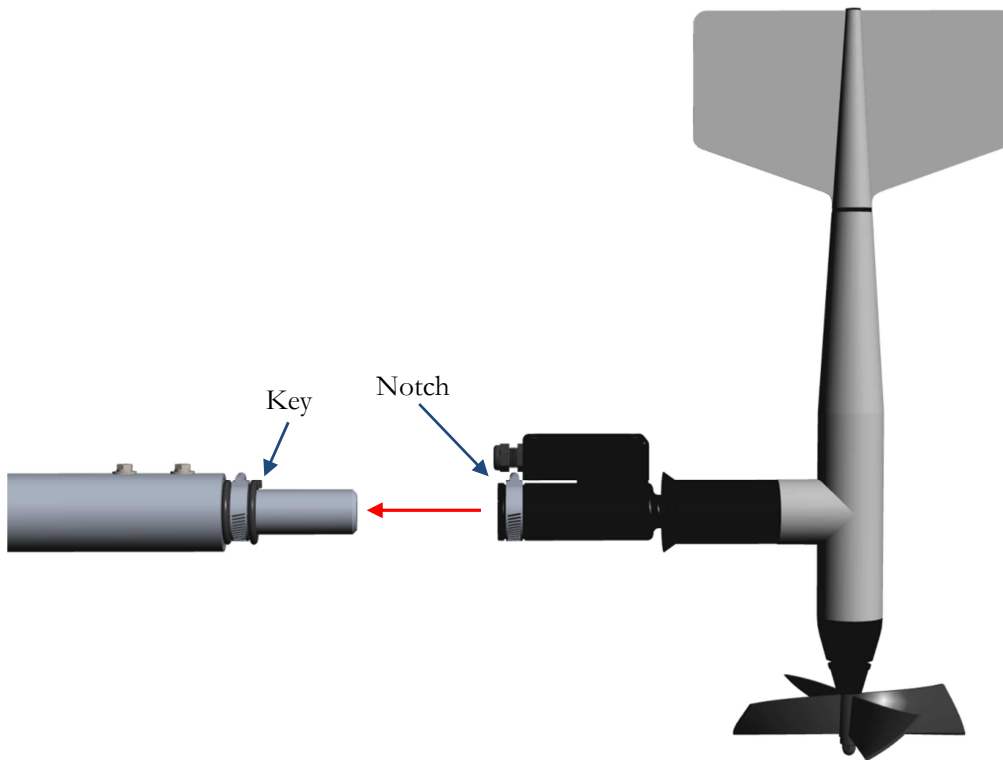


Figure 3-4: R.M. Young installation

3.1.4 Sensor connection

Using plastic ties, lay out and tie the cables along the mast, tying every several feet. Ensure the cable loops over the mast union in order to prevent chafing and damage.

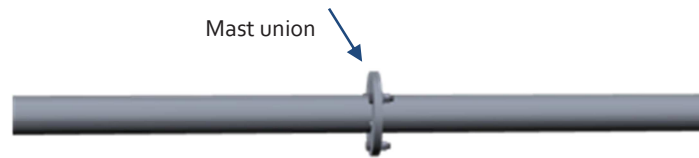


Figure 3-5: Mast union

3.1.5 Raise mast

Raise the mast, apply grease to the pinning bolt and secure with the lock nut. Ensure the wind sensor cable has a loop at the bottom of the mast to prevent pulling when raising and lowering the mast. Tie cables underneath the frame to prevent them from being stepped on when someone is climbing the frame. Route the cable into the enclosure and connect the orange color coded cable connector to an SDI port on the datalogger.

3.2 MPF mast installation

For new installations the mast should already be in a lowered position and pointing WEST.

For upgrades or servicing, disconnect guy wires (leave True West Guy Wire connected), remove 4" pinning bolt from U-shaped bracket and gently lower mast. Allow mast to ride in horizontal place supported by its safety cable. In an ideal situation the tower mast will be aligned to point west.

3.2.1 R.M. Young mount

Insert R.M. Young arm into the notch of the top mast extension and make sure that the decal on the arm is pointing to the north. Align the square notch in the R.M. Young arm with the notch in the mast extension, insert bolts, and tighten.



Figure 3-6: MPF R.M. Young mount installation

3.2.2 R.M. Young wind sensor

Install the propeller on the shaft with the serial number facing into the wind, and secure with plastic nut. Slide R.M. Young onto the mount and align notch at instrument base with the pin in the arm. Snug instrument hose clamp.

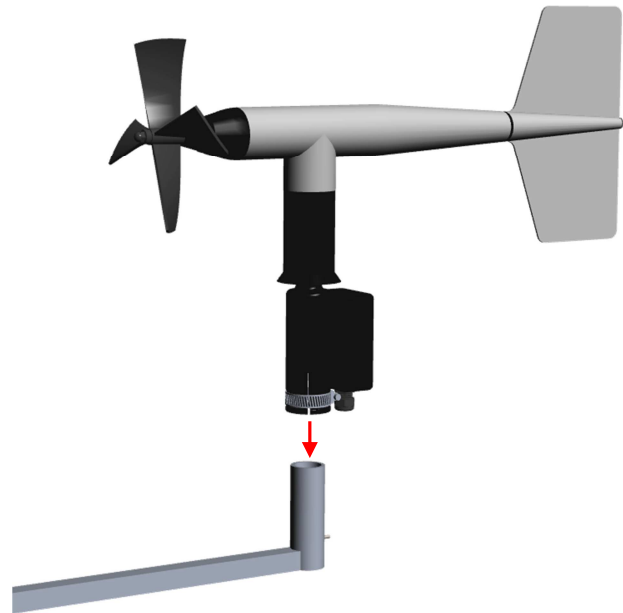


Figure 3-7: MPF R.M. Young installation

3.2.3 Sensor connection

Using plastic ties, lay out and tie the cables along mast, tying every several feet. Ensure the cable loops over the mast union in order to prevent chafing and damage.

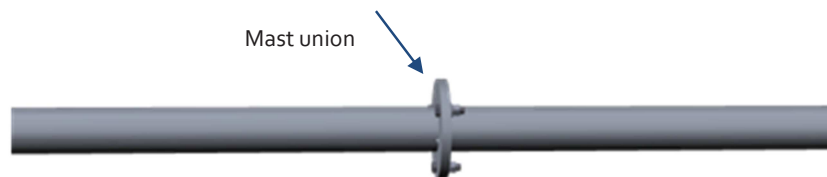


Figure 3-8: Mast union

3.2.4 Raise mast

Raise the mast, apply grease to the pinning bolt and secure with the lock nut. Ensure the wind sensor cable has a loop at the bottom of the mast to prevent pulling when raising and lowering the mast. Tie cables underneath the frame to avoid being stepped on when climbing frame.

3.3 Handar upgrade installation

For new installations the mast should already be in a lowered position.

Slide the R.M. Young mount over the end of the tower mast as indicated and tighten the bolts to secure the mount to the mast. Move to “Section 4.1.1” and follow the steps for installing the orientation ring as well as mounting the wind sensor.

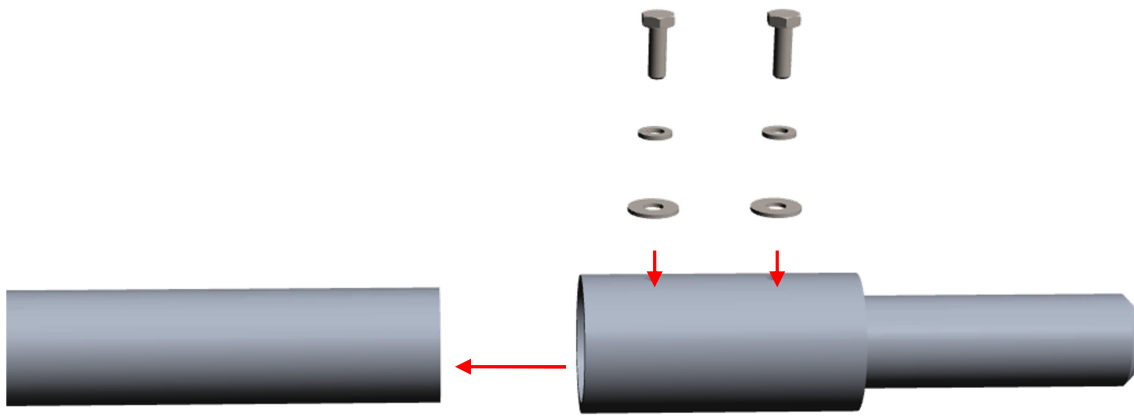


Figure 3-9: Handar R.M. Young mount installation



Chapter 4 Technical Specifications

4.1 General

Sensor type	Interface module for R.M. Young Model 05103 Wind Sensor
Interface	SDI-12, ver. 1.3
Wind speed range	0.8 m/s to 125 m/s
Measurement delay	0 (data values are available immediately from module)
Operating temperature range	-40 °C to +60 °C
Operating humidity range	0% to 100%
Power supply voltage	12 Vdc nominal (range: 9.6 to 16 Vdc)
Standby current consumption	Less than 1 mA
Active current consumption	1 mA
Dimensions	Fits standard R.M. Young enclosure
Weight	0.2 kg

4.2 Interface to R.M. Young wind sensor

AC input voltage	80 mV to 16 V
AC input frequency	0.5 Hz to 1.1 kHz
Wind direction excitation voltage	3 V to 3.3 V
Wind direction resistance	5 k Ω to 20 k Ω