FT702LM Wind Sensor
Manual

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3A4208EN
Nov 2012

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1 INTRODUCTION

The FT702LM is a solid-state wind sensor, which uses a patented Acoustic Resonance airflow sensing technique to measure accurately both wind speed and direction.

The acoustic resonance sensing technique coupled with state-of-the-art signal processing gives the anemometer a wind speed range of 0 to 50m/s with a resolution of 0.1m/s.

Comprehensive measurement data (up to 5 readings per second) is available via either a serial RS422 interface featuring full-duplex operation or a RS485 interface featuring half-duplex operation

The highly compact and symmetrical arrangement of the acoustic resonant cavity results in a physically small (50mm x 78mm), lightweight (250g) and robust anemometer. When mounted on a suitable enclosure the FT702LM is environmentally sealed to IP66 allowing it to be used in a wide range of demanding applications. A hard anodised surface protection coating offers an easy clean, highly durable surface finish.

The FT702LM is ideal for battery powered applications and is able to operate at supply voltages as low as 4.4V (@ 12mA typical current drain).

The FT702LM is available either with an internal compass (FT702LM2) or without (FT702LM1). With the FT702LM2 the wind direction output can be obtained either relative to magnetic North or, by using the declination angle function, relative to true North.

An integral heater is incorporated to prevent icing. The heater can either be switched on or off as required or it can be automatically controlled directly by the sensor.

1.1 Warranty

FT Technologies warrants that all goods manufactured by it shall be reasonably free from defects in materials and workmanship at the time of their delivery to the Purchaser.

In the event of failure which is deemed to arise from a failure of design or manufacture by FT Technologies, FT Technologies will at its discretion either replace or repair the defective sensor, if the sensor is within its warranty period.

1.2 Scope of Use

The FT702LM is designed, manufactured and optimised for wind speed and wind direction sensing. The sensor is designed to have high availability. The FT702LM wind sensors often attain 99.9% or better availability of wind speed and wind direction readings.

No promise in part or full (see Disclaimer section 1.3) can be given to guarantee an FT702LM wind sensor's continuous operation, as exceptional circumstances can occur that may result in the failure of the output from a sensor. Exceptional circumstances can include;

- Poor installation
- Inadequate inspection
- Power supply failures
- Poor quality electrical connections
- Lightning exposure
- Problematic environmental conditions or combination of conditions

FT Technologies accepts no liability for the loss of output from a wind sensor or other losses due in whole or in part to the failure or partial failure of an FT Technologies wind sensor.

Typically higher levels of wind speed and wind direction data availability are achieved through the use of additional sensors or mix-technology (e.g. solid-state / mechanical sensors) or data logging strategies or controller algorithms, which compensate in whole or in part, for any temporary interruption of data from individual sensors. The choice and implementation of such methods is entirely the Purchaser's responsibility.

1.3 Disclaimer

There are no warranties, representations or conditions, expressed or implied of any kind given in this manual for any particular design application. The Purchaser should independently undertake sufficient testing to confirm validity and suitability of any design. The Purchaser assumes all risks and liability in conjunction with the use of the information given.

FT Technologies can take no responsibility for the effectiveness of any sensor lightning protection scheme implemented. The wind sensor has passed a wide range of EMC tests but FT Technologies does not warrant the sensor to survive direct or indirect lightning strikes.

Information supplied by FT Technologies Ltd. shall not be construed as permission to license to operate under, or recommendation to infringe any existing or pending patent, patent applications or trademarks.

2 FUNCTIONAL DESCRIPTION

2.1 Technical Performance

Please see the datasheet, section **Technical Specification** for more details.

Please click on web link and download our datasheet from our product profile page:
http://www.fttech.co.uk/ft702-lm-wind-sensor/

2.2 Product Options

The available options for the FT702LM are listed below:

Append required option

FT702LM _

Options:
1 = RS-422 Output, Compass Module Not Fitted
2 = RS-422 Output, Compass Module Fitted
5 = RS-485 Output, Compass Module Not Fitted

2.3 Outline Drawing

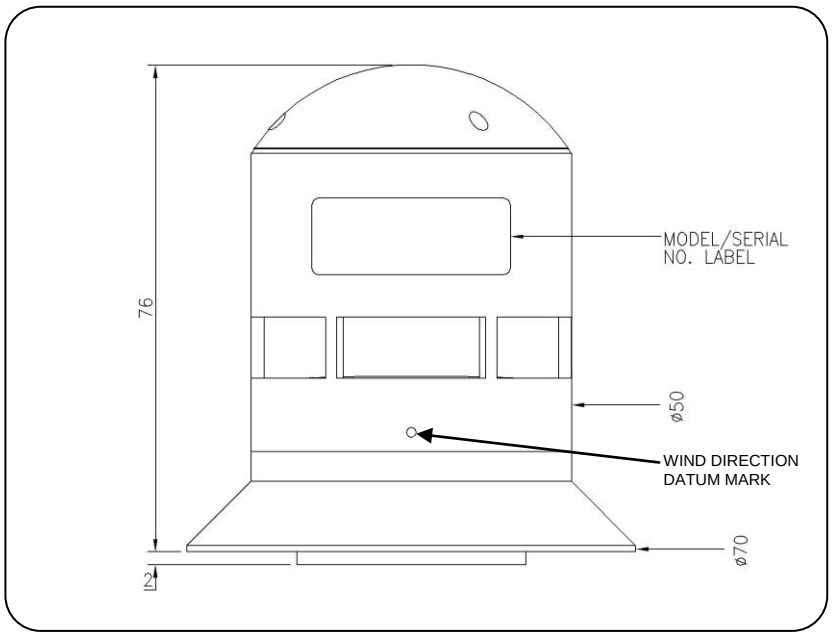
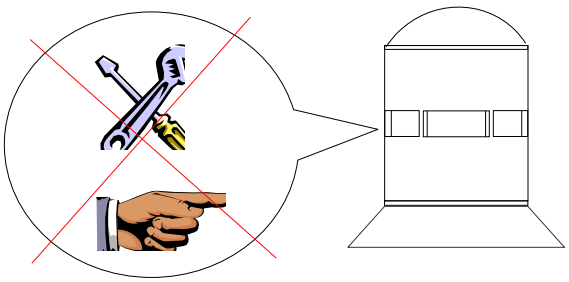


Figure 1 - FT702LM Outline Drawing

Warning – do not attempt disassembly as damage may result to internal wiring.



WARNING

DO NOT **INSERT OBJECTS INSIDE CAVITY**

3 INSTALLATION

3.1 Mounting and Aligning the FT702LM

The FT702LM is designed for mounting via the 6 fixing holes located around the base of the anemometer housing. See Figure 2 - for a view of the FT702LM base. For the FT702LM2 use non-magnetic fixing screws to secure the sensor in position. Ensure that the supplied gasket is correctly positioned in the base of sensor before fitting in position. The 6 fixing holes are tapped to a depth of 5mm.

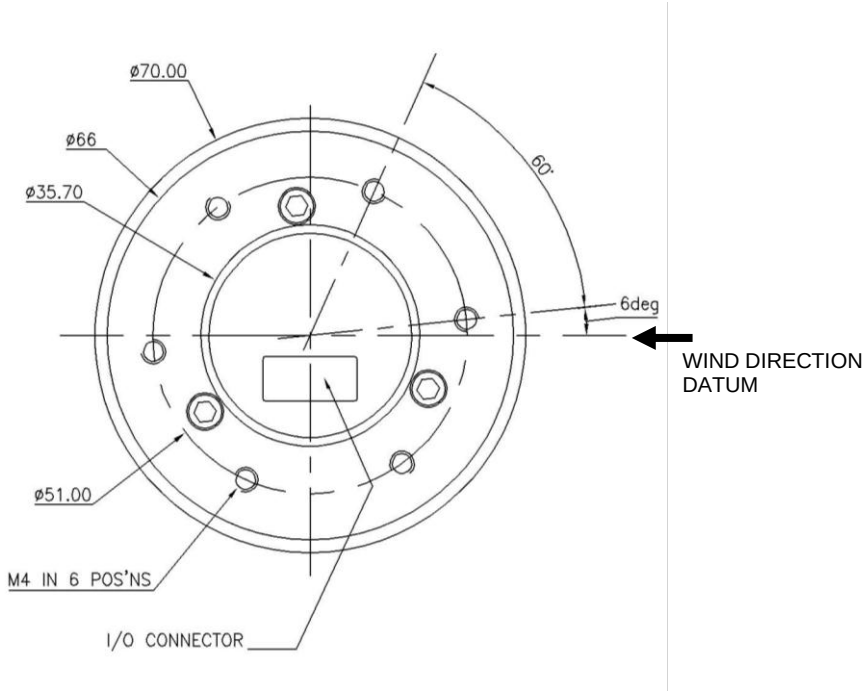


Figure 2 - Underside View of the FT702LM

Evenly tighten each fixing screw in turn so that the gasket compresses sufficiently to form a watertight seal.

For the FT702LM2 avoid locating the sensor near ferrous objects or high current cables as this may affect the operation of the on-board compass module.

The body of the FT702LM is marked with a small circular indentation datum mark (located below the sensor nameplate label). This datum mark indicates the 0^{o} wind direction for the all FT702LM sensors (unless the compass function has been enabled in the FT702LM2).

When installed without the compass function enabled the datum direction should be aligned to North. For mobile installations (i.e. on a vehicle or vessel) the datum mark should be aligned with the required measurement axis (i.e. on a ship pointing towards the bow). In applications where mechanically aligning the sensor datum is difficult or where no provision has been made to rotate the sensor to align with the datum direction a software command (see Section 3.3.3) to electronically 'rotate' the sensor datum is available.

When the compass function is enabled on the FT702LM2 the wind direction is measured relative to North and it is not necessary to physically align the datum direction.

3.1.1 Wind Direction Conventions

The body of the FT702LM is marked with a small circular indentation datum mark (located below the sensor nameplate label). This datum mark indicates the 0^{o} wind direction for the all FT702LM sensors (unless the compass function has been enabled in the FT702LM2).

When the compass module enabled (only available in LM2) the wind direction output is then given relative either to magnetic North.

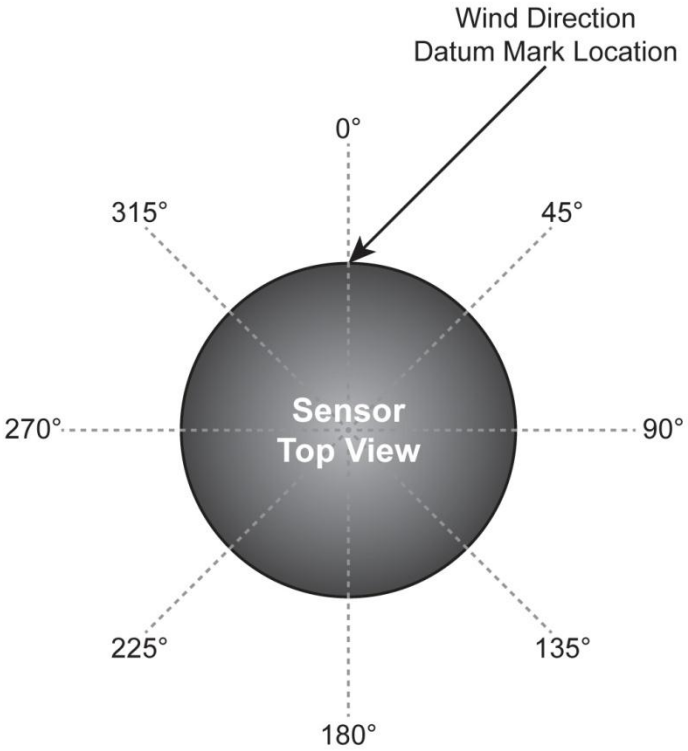


Figure 3 - Wind Direction Conventions

3.2 Connectivity

All electrical connections are made to the FT702LM via a 10-way latching connector located in the base of the wind sensor housing. The mating connector accepts crimp tail contacts. Suitable crimp tools and contact insertion tools can be obtained directly from the connector manufacturer (Harwin – www.harwin.com). The connector pinouts are shown in Figure 4 and the connector/mating connector manufacturer's part numbers in Figure 5. (***Note: Care should be exercised when disengaging the connectors so as not to damage the fixed connector latches. A separator tool (order code T5746) is available from the connector manufacturer for this purpose).***

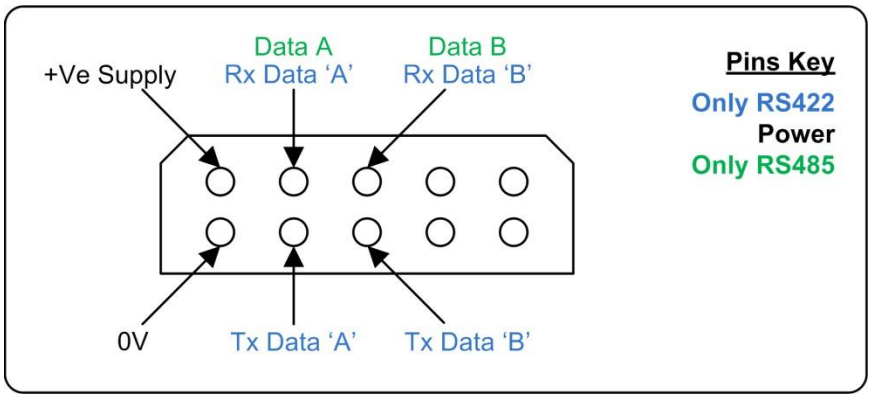


Figure 4 - Connector Pin Details

	Manufacturer	Part No.
Fixed Connector	Harwin	M80-8671022
Mating Connector	Harwin	M80-8891005 (crimp - large bore 22AWG)
Spare Crimp Contacts	Harwin	M80

Figure 5 - Connector details

3.3 Configuring the FT702LM

All user parameter settings are stored in EEPROM memory and are retained when the FT702LM is switched off. When the FT702LM is next switched on (or a user reset command is sent) the FT702LM will revert to these settings. The FT702LM can therefore be configured as required prior to final installation if required. For example, the FT702LM can be pre-configured to output wind velocity readings continuously (i.e. without a command having to be sent to request data) at a preset rate for use in applications where commands cannot be sent to the FT702LM.

The FT702LM settings can be returned to the factory values (see Figure 13 for factory default settings) at any time by sending the factory reset command.

The signal state definitions for the serial interface data lines are as follows:

i) the idle, marking, logical "1", OFF or stop bit state is defined by a negative voltage on line A with respect to line B.

ii) the active, spacing, logical "0", ON or start bit state is defined by a positive voltage on line A with respect to line B.

To reduce the quiescent power consumption of the FT702LM the transmitter is disabled when data is not being sent and the output lines are put into a high impedance state. It is recommended that pull-up and pull-down resistors are used on the output lines so that the output is maintained in the idle logic state when the transmitter is disabled. This will prevent spurious signals being generated each time the transmitter is enabled. To define the idle state connect a 750ohm resistor from the FT702LM Data B Tx line to the logic +Vcc supply and a 750ohm resistor from the Data A Tx line to 0V.

3.3.1 Configuring the FT702LM Compass (FT702LM2 Only)

The FT702LM2 version of the FT702LM is fitted with a solid-state electronic compass so that the wind direction output is automatically measured relative to North. The wind direction can be measured either relative to magnetic North, or by programming the FT702LM2 with the geographical location declination angle, relative to true North. The compass function can also be disabled if required so that the wind direction is measured relative to the datum mark on the wind sensor body. The compass heading can also be read back at any time using the CF command. See Section 4.3.4 for full details of the CF command. Both the Polar format (P) and NMEA 0183 format (N) outputs provide wind direction data relative to North (if the compass function is enabled). The NMEA 0183 message also has a field that indicates whether the compass module is enabled or disabled.

3.3.2 Calibrating the FT702LM Compass Module (FT702LM2 Only)

The effects of fixed local magnetic fields (i.e. those caused by magnetised ferrous material close to the compass) can be compensated for by performing an *in situ* compass calibration. Use the CF command (Section 4.3.4) to check if the magnetic distortion is present. If the magnetic distortion flag is set then a compass calibration should be performed. It is important that the calibration is performed with the FT702LM mounted in its final position within the host system. The calibration can only compensate for *fixed* magnetic fields generated by the host system. Varying fields caused, for example, by ferrous objects passing near the FT702LM (say by a car or truck) or high current electric circuits will not be corrected. Should the magnetic signature of the host system change significantly (because component parts have been added or removed), then a recalibration may be required.

To calibrate the FT702LM compass proceed as follows:

(calibration should be performed away from any external stray magnetic fields)

1) Mount the FT702LM in its final position within the host system

2) Send the CFC ‘enable calibration’ command ***Important:*** *No further commands should be sent to the FT702LM after the CFC command has been sent.*

3) Slowly rotate the host system 2 complete revolutions in the horizontal plane. Each revolution should take between 2 and 5 seconds.

4) To complete the calibration send the CFE ‘enable compass’ command

3.3.3 Electronically Offsetting the Wind Direction Datum

For applications where the compass is not being used the wind direction datum can be ‘electronically’ rotated using the CF command. The declination angle function normally used in conjunction with the compass function can be used to realign the datum position anywhere in the range 0-359.9°.

See Section 4.3.4 for further details

3.4 The FT702LM Heater

The FT702LM is fitted with an integral dual element heater that can be used to help prevent icing-up of the sensor in sub-zero temperatures.

The heater is controlled automatically by the FT702LM using a user programmable ‘set point’ temperature. The FT702LM adjusts the average temperature of the sensor using a proportional integral control scheme which gradually increases the current drawn until the programmed set point is reached.

The supply voltage range for heater operation is 10V to 30V. The heater current is electronically limited to 2.5A so the heater power will vary from 25W (at 10V supply) to 75W (at 30V).

Since the heater circuit is thermostatically controlled the actual power being drawn from the supply will depend on the programmed set point and the prevailing environmental conditions (i.e. ambient temperature, wind speed, precipitation etc).

The factory default setting for the set point value is 99 (heater off). To use the heater the set point value must be programmed using the HT command (Section 4.3.10). The HT command can also be used to read back the % (of full scale) heater current setting being used by the FT702LM as well as the internal temperature of the FT702LM.

When using the FT702LM heater the user must ensure that the supply is able to provide the full rated current of 2.5A.

The minimum required supply voltage for operating the heater is 10V. After power is applied to the FT702LM the supply voltage is metered and if it is above 9.8V the heater circuit is enabled. (Although the heater is enabled it will only switch on if the heater setpoint is above the internal temperature of the FT702LM). Should the supply voltage fall below 7.8V then the heater will be disabled (heater will turn off even if heater setpoint is above internal temperature). A rise in the supply voltage to 9.8V will enable the heater again.

To unconditionally disable the FT702LM heater under all circumstances (i.e. irrespective of the setting of the set point) use a voltage supply of 9V or less.

The heater can be operated from either single or dual voltage supplies.

3.4.1 Single Supply Operation

Use single supply operation when the power supply is able to provide 2.5A. Power the FT702LM from a supply with a voltage output of 10V-30V and program the heater set point to the required temperature using the HT command. The heater will automatically switch on whenever the temperature of the FT702LM falls below the set point temperature. ***If operating with a voltage supply, V>10V that is not rated at 2.5A or above the heater setpoint must be set to 99 (heater off) to disable heater operation otherwise supply overload will occur.***

3.4.2 Dual Supply Operation

In applications where a separate high current supply (voltage >10.5V) is available, in addition to a low power (voltage < 7V) supply, then the FT702LM can be operated in dual supply mode. To operate in this mode two external schottky diodes should be used to connect the two supplies to the +V supply of the FT702LM – see Figure 6.

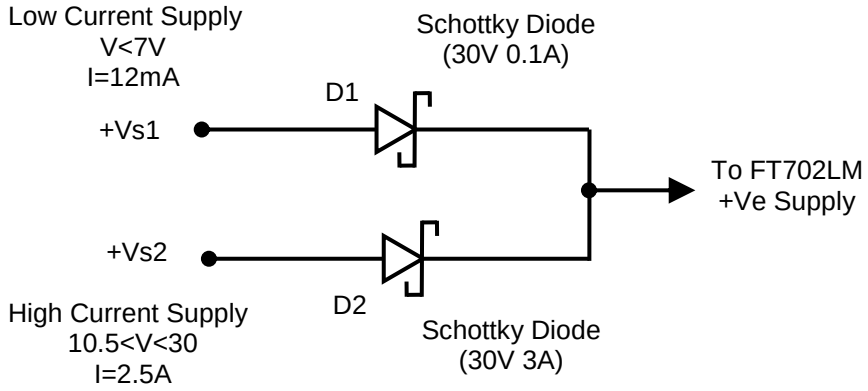


Figure 6 - Dual Supply Heater Operation

With both supplies connected as shown in Figure 6 the FT702LM will be powered from the Vs2 (diode D1 reversed biased) supply. If supply Vs2 is disconnected (or if Vs2 falls below 7.8V) the heater circuit will be disabled and the FT702LM will be powered from supply Vs1. Because supply Vs1 is less that 7.8V the heater is unconditionally disabled until supply Vs2 is reinstated.

3.5 NMEA 0183 output option

The FT702LM can be configured for use in systems conforming to the National Marine Electronics Association NMEA 0183 'Standard For Interfacing Marine Electronic Devices' version 2.30. This standard defines electrical signal requirements, data transmission protocol and timing, and specific sentence formats for a 4800-baud serial data bus. Copies of the standard may be obtained from:

NMEA National Office
P.O. Box 3435
New Bern
NC 28564-3435
USA

Web site: http://www.nmea.org

Either an FT702LM1 or FT702LM2 can be used in an NMEA 0183 system. The wind sensor acts as a Talker, transmitting wind speed and wind direction information using the MWV (wind speed and angle) approved sentence formatter. The FT702LM1 or FT702LM2 must be pre-configured for NMEA 0183 operation prior to final installation.

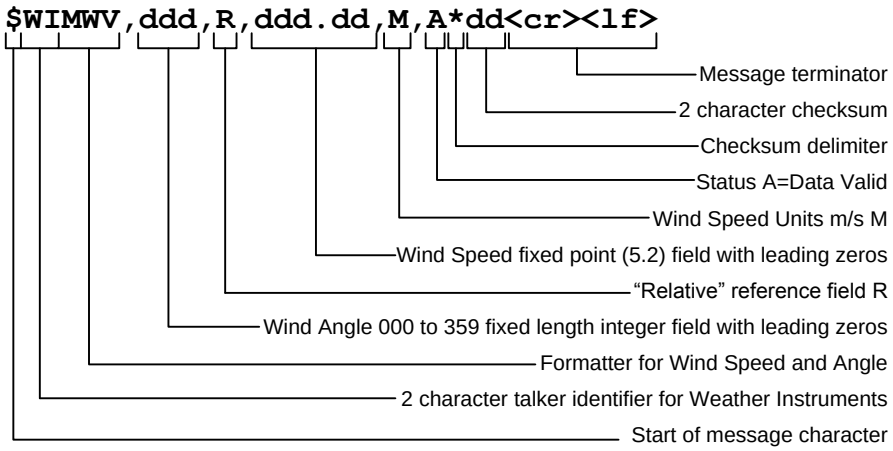


Figure 7 - Output Data Format in NMEA 0183 Mode

To configure an wind sensor for use in an NMEA 0183 system follow the steps below:

Firstly connect the FT702LM1 or FT702LM2 to a suitable RS422 terminal or terminal emulator so that commands can be sent to the wind sensor. If the FT702LM is in continuous update mode use the CU command (Section 4.3.5) to disable continuous updating.

1. Set the baud rate
   Devices connected to an NMEA 0183 system communicate using a fixed baud rate of 4800. If the FT702LM baud rate is not currently set to 4800 baud then it should be changed using the BR command (Section 4.3.3). (Note: If the baud rate of the FT702LM is changed then the terminal baud rate will also need to be changed before communication can be resumed with the FT702LM.)

2. Set the output data format
   The FT702LM supports the NMEA 0183 approved sentence, MWV – Wind Speed and Angle. The FT702LM can be set to output the MWV sentence by using the DFN command (Section 4.3.6).

3. Set filter and heater settings.
   If required change the settings for the FT702LM filter (FL command) and heater (HT command).

4. Put the FT702LM into Continuous Update mode. (Mode only available on LM1 or LM2 wind sensors)

The FT702LM does not act as Listener in an NMEA 0183 system and therefore cannot receive any commands. The FT702LM must therefore be set to operate in the continuous update mode before installation into the NMEA 0183 system. Use the CU command (Section 4.3.5) to set the FT702LM to output wind speed and wind direction readings continuously. The required update rate (usually not greater than 1 per second for a NMEA 0183 system) is also set using the CU command.

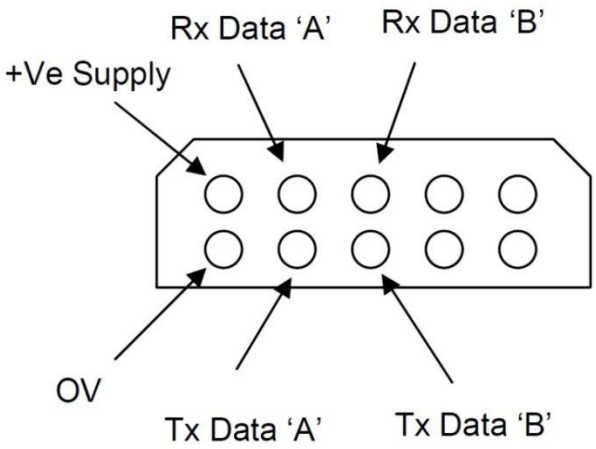
Connector Type	See Figure 5
Connector Pin Designations:	
 *Diagram only applicable to RS422 connections*	
Talker Output Drive	35mA
Output Transmitter	RS422 Compatible
Approved Talker Sentence(s)	MWV – Wind Speed and Angle (reference field set to R = Relative)
Interval between Readings	User programmable (0.2 sec to 12,000 sec)
Listener Input Load	Not Applicable
Recognised Listener Sentences	None
NMEA 0183 Compliance	NMEA 0183 Version 2.30, March 1 1998

Figure 8 - NMEA 0183 Operating Information

Note: If the FT702LM2 is being used in a fully NMEA 0183 compliant system then it must be operated with the compass function disabled so that the wind direction output is in Relative format (i.e. not referenced to magnetic North)

4 Sensor Communication

4.1 Introduction

The FT702LM is fitted with a RS422 full duplex or RS485 half duplex interface. The FT702LM features an easy to use ASCII-based communication protocol. The protocol incorporates checksum validation to ensure the integrity of all data transmissions, as well as unit addressing for systems incorporating more than one FT702LM.

4.2 Communication

4.2.1 Conventions used in this manual

All examples of FT702LM transmitted and received messages are printed in italic courier monospace font, e.g.

$<listenerID>,DFP<checksum><cr><lf>*

Angle brackets are used as placeholders for data (e.g. <wind speed>) or for non-printable ASCII characters (e.g. <cr> for carriage return).

Figure 9 lists the various special characters and symbols which are used in the examples given in this Handbook.

Symbol	Valid Characters	HEX Values	Definition
a	{A to Z} {0 to 9} {/}	41-5A, 30-39, 2F	talker/listener address field characters
c	{A to Z} {0 to 9}	41-5A, 30-39	fixed length field of alpha (upper case only) and numeric characters
h	{A to F} {0 to 9} {/}	30-39, 41-46, 2F	checksum field validation characters
x	0 to 9	30-39	fixed length field of numeric characters
x.x	{0 to 9} {.}	30-39, 2E	fixed point numeric field (i.e. always with leading and trailing zeros)
±	{+ -}	2B, 2D	polarity indicator. Where a value can take on both positive and negative values a polarity indicator (either + or -) is always sent as the first character in the field. The field length therefore remains fixed for both positive and negative values.
	{$}	24	start of message delimiter
	{*}	2A	checksum field delimiter
	{,}	2C	field delimiter
<cr>		0D	Carriage return / Line feed ┐— End of message delimiter
<lf>		0A	
<name>			placeholder for data

Figure 9 - Symbols used in this Handbook

4.2.2 Data Transmission

Data is transmitted and received via an asynchronous serial communication interface using ASCII characters. The interface operates with the following parameters:

Parameter	Setting
Baud Rate	1200, 2400, 4800, 9600(factory default), 19200, 38400
Data Bits	8
Start Bits	1
Stop Bits	1
Parity	None

Figure 10 - Data Transmission Parameters

To set the FT702LM baud rate use the BR command (Section 4.3.3).

The FT702LM does not use handshaking (either hardware or software) to control the flow of data to and from the host controller. It is important, therefore, that the serial interface of the host controller is set with handshaking/flow control disabled.

4.2.3 Message Format

Data communication between the FT702LM and the host controller is performed by the transmission of ASCII messages. Figure 11 shows the composition of the message. The same message format is used for both received and transmitted messages.

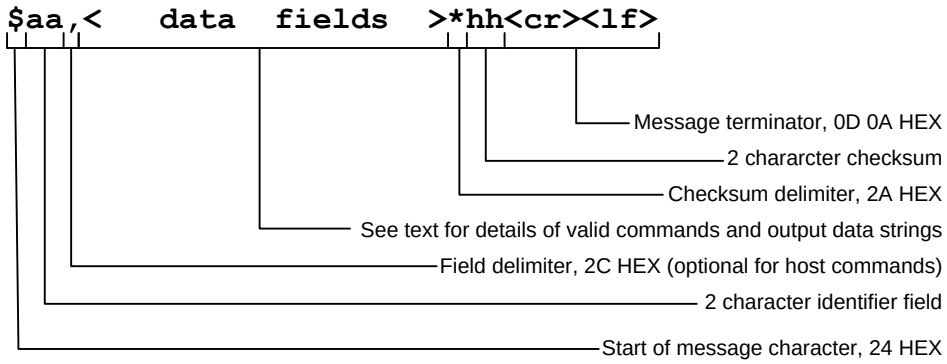


Figure 11 - Message Format

All messages start with the '$' start of message character, followed by the 2 character talker/listener identifier (Section 4.3.11) field.

Following the first delimiter is the main body of the message which comprises a variable number of data fields (dependent on the message being transmitted), each separated by the field delimiter character (','). Data fields may contain alpha, numeric, or alphanumeric data depending on the information content of the field. Data fields are always fixed length with leading and trailing zeros being sent.

Messages sent to the FT702LM will contain a command in <data fields> and messages transmitted from the FT702LM will contain output data in <data fields>. A detailed description of the commands and output data strings is given in Section 4.3.

The data field section of the message is terminated by the checksum delimiter character '*'. Following the checksum delimiter is the two-character checksum field. See Section 4.2.5 for information on how to compute the checksum and Section 4.2.6 if checksum message validation is not required.

All messages are terminated with a carriage return <cr> and line feed <lf>.

4.2.4 Listener and Talker Identifiers

The FT702LM is assigned with both a Listener and Talker identifier address that allows an individual FT702LM to be uniquely identified in a system comprising of more than one FT702LM.

Whenever a message is sent to the FT702LM, the identifier field of the message (the 2 characters immediately following the '$' start of message character) must correspond to the FT702LM Listener identifier address, otherwise the FT702LM will ignore the message. In RS422 multi-listener applications, you should assign each FT702LM in the system a unique Listener ID. The host controller will then be able to address individually each FT702LM. If you do not wish to use the Listener ID in messages sent from the host controller, you can replace the Listener ID with '//'. Sending '//' in place of the Listener ID will allow any FT702LM, irrespective of its Listener ID setting, to respond to the message.

Whenever a message is transmitted from the FT702LM, the identifier field of the message (the 2 characters immediately following the '$' start of message character) will contain the Talker ID. The Talker ID is used as a message tag to identify which FT702LM has transmitted the message.

The factory default value for the Listener ID is 01 and for the Talker ID it is WI (Weather Instrument). To change the Listener and/or Talker ID use the ID Command, Section 4.3.11.

4.2.5 Calculating the Message Checksum

All messages sent to, or received from, the FT702LM include a checksum field. Messages that are transmitted from the FT702LM always include a checksum value in the checksum field. Messages sent to the FT702LM by the host controller can either contain a checksum value or an 'ignore checksum identifier' in the checksum field.

The checksum value is calculated by Exclusive OR'ing (XOR'ing) all the bytes between (but not including) the '$' and the '*' characters of the message. The resulting single byte value is then represented by 2 HEX characters in the message string. The most significant character is transmitted first.

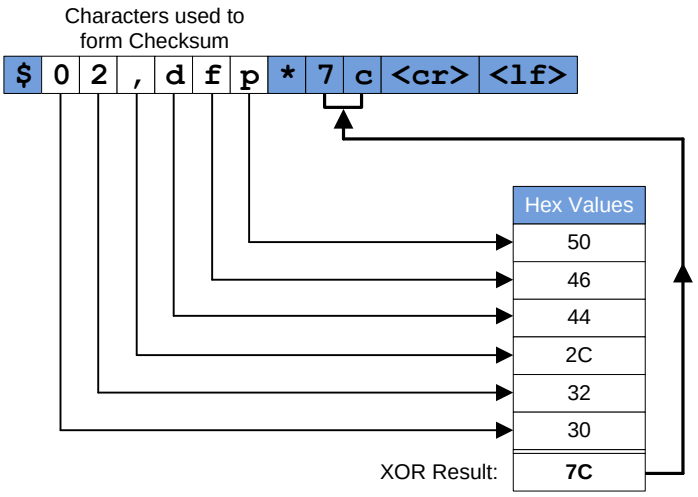


Figure 12 - Checksum Example

Note: since a message only contains ASCII characters (which have values in the range 0-7F) the checksum value will always be between 0 and 7F.

4.2.6 Disabling the Checksum

All messages which are sent to the FT702LM must contain a valid checksum value in the checksum field, otherwise the FT702LM will not process the incoming message. Although it is recommended that a checksum value be computed for all messages which are sent to the FT702LM, in some cases this may not be convenient (i.e. when communicating with the FT702LM with a terminal). To prevent the FT702LM from performing checksum validation of incoming messages, send the ASCII characters '//' in place of the checksum value.

Example:

Send a message to set the data output format to Polar using the DFP command (the FT702LM Listener ID in this example is set to 02)

With a checksum (FT702LM checksum validation automatically enabled):

*$02DFP*50<cr><lf>*

Without a checksum (FT702LM checksum validation automatically disabled):

$02DFP//<cr><lf>*

A checksum value is always transmitted by the FT702LM with every outgoing message. However the checksum field can be ignored by the host controller if checksum validation for received messages is not required.

4.3 FT702LM Commands

4.3.1 Sending Commands to the FT702LM

Figure 13 lists the commands that may be sent to the FT702LM from the host controller. A command can SET an FT702LM parameter value, or QUERY the current value of an FT702LM parameter or reading.

Command	Mnemonic	Type	Factory Default	Section
Serial interface baud rate	BR	S/Q	9600	4.3.3
Compass function	CF	S/Q		4.3.4
Continuous update	CU	S/Q	Disabled	4.3.5
Wind velocity data format	DF	S/Q	Polar	4.3.6
Command delay interval	DL	S/Q	01	4.3.7
Error report	ER	S/Q		4.3.8
Wind velocity filter	FL	S/Q	Enabled	4.3.9
Heater settings	HT	S/Q	Disabled	4.3.10
Listener and talker identifiers	ID	S/Q	Listener ID = 01 Talker ID = WI	4.3.11
Min/Max wind speed	MM	S/Q		4.3.12
Reset	RS	S		4.3.13
Wind velocity reading	WV	Q		4.3.14
Key: 'S' signifies that command can SET a value or change a setting 'Q' signifies that command can QUERY an existing value or setting				

Figure 13 - FT702LM Commands

When a valid command is received by the FT702LM input buffer, it will be processed within 50-100ms (unless the command delay interval has been extended with the DL command, Section 4.3.7). The actual command latency depends on exactly when the command is received within the FT702LM internal processing cycle.

The FT702LM can process one command during each internal 50ms cycle. If more than one command is received within any one cycle, only the first command will be recognised. It is important therefore that commands are always separated by at least 50ms. (Note: if the command delay interval has been extended by using the DL command then commands must be separated by at least the DL interval plus 50ms).

When the FT702LM is set to output readings in continuous mode (see Section 4.3.5), the FT702LM output buffer is reserved exclusively for wind velocity readings and the FT702LM can only respond to SET commands and not QUERY commands. To allow the FT702LM to respond to QUERY commands, disable the continuous updating with the CUD command.

Each command, and its usage, is described in the following Sections. All examples, other than where stated, assume that the FT702LM Listener ID is set to 01, and the FT702LM TalkerID is set to WI, (Weather Instrument).

4.3.2 Verifying Commands

When a valid message is recognised by the FT702LM, the FT702LM will carry out the command contained in the message. To verify that the command has been successfully carried out, send the corresponding QUERY command after sending the SET command. For example, to set the wind velocity output to Polar format and verify that the command has been accepted, send the following commands:

Set the wind reading format to polar:
$//DFP//<cr><lf>*

Query setting to confirm command has been carried out:
$//DF?//<cr><lf>*

Read FT702LM response:
*$WI,DF=P*5D<cr><lf>*

4.3.3 Command: BR Set or query the serial interface baud rate

Command Parameter	BR

Command Syntax		
	SET Sensor:	*$<listenerID>,BR<baudrate>*<checksum><cr><lf>* *$aa,BRx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,BR?*<checksum><cr><lf>* *$aa,BR?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,BR=<baudrate>*<checksum><cr><lf>* *$aa,BR=x*hh<cr><lf>*

Parameters	<baudrate>	
	0	Set the baud rate to 38400 baud
	1	Set the baud rate to 19200 baud
	2	Set the baud rate to 9600 baud (Factory Default Setting)
	3	Set the baud rate to 4800 baud
	4	Set the baud rate to 2400 baud
	5	Set the baud rate to 1200 baud

Examples	Example 1 Set the baud rate to 19200 baud, verify the new setting and send a user reset command to activate the new baud rate	
	Message	Comment
	$01,BR1//<cr><lf>*	Set baud rate to 19200
	$01,BR?//<cr><lf>*	Query baud rate setting
	*$WI,BR=1*2E<cr><lf>*	FT702LM output
	$01,RSU//<cr><lf>*	Send user reset

Description	Use the BR command to change the FT702LM serial interface baud rate. The new baud rate setting will only come into effect when the FT702LM is next powered-up or after a Reset command (RSU) has been received. If the baud rate is changed, you will only be able to communicate with the FT702LM if the host controller baud rate is set to the same baud rate. If you do not know what the current setting of the FT702LM baud rate is you will need to try each baud rate in turn until you establish communication.

4.3.4 Command: CF Set or query the compass parameters

Command Parameter	CF(heading)

Command Syntax		
	SET Sensor:	*$<listenerID>,CF<mode>*<checksum><cr><lf>* *$aa,CFc*hh<cr><lf>* *$<listenerID>,CF<heading>*<checksum><cr><lf>* *$aa,CFxxx.x*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,CF?*<checksum><cr><lf>* *$aa,CF?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,CF=<mode>,<status>,<heading>,<dec>* <checksum><cr><lf>* *$aa,CF=c,c,xxx.x,xxx.x*hh<cr><lf>*

Parameters		
	<heading>	
	000.0 to 359.9	Compass heading in degrees
	<mode>	
	C	Enable calibration mode
	D	Disable compass function
	E	Enable compass function
	<status>	
	D	Compass module either disabled or not present
	M	Magnetic distortion present
	V	Valid compass reading
	<dec>	
	000.0 to 359.9	declination angle. Standard convention requires that westward declination angles are subtracted from magnetic heading in order to derive true heading. Conversely eastward declination angles are added to magnetic heading. However, since the declination angle on the FT702LM is provided in the form 0 to 359.9deg, the user must write westerly declination in the form (360 – westerly declination). For example, a westerly declination of 10deg would be sent to the FT702LM as 350deg.

Examples		
	Example 1 Set the declination angle to 5deg East and read the compass parameters	
	Message	Comment
	$01,CF005.0//<cr><lf>*	Set declination angle to 5deg
	$01,CF?//<cr><lf>*	Query compass parameters
	*$WI,CF=D,D,355.0,355.0*26<cr><lf>*	FT702LM output
	The datum direction of the FT702LM is pointing 5deg to the right of the turbine axis (viewed from rear of turbine) – set the offset to bring the FT702LM datum in line with the turbine axis	
	Message	Comment
	$01,CF005.0//<cr><lf>*	Set offset angle to 5deg
	$01,CF?//<cr><lf>*	Query parameters
	*$WI,CF=E,V,045.0,005.0*31<cr><lf>*	FT702LM output

Description	Use the CF command to access the compass related features of the FT702LM

WARNING: Once set, the offset value is retained within the non-volatile memory. If the sensor is moved to another position the offset value must be changed to suit the new installation or set to zero otherwise incorrect wind direction readings will be obtained.

4.3.5 Command: CU Set or query the continuous update setting

Command Parameter	CU (Command only available on LM1 &LM2)

Command Syntax	SET Sensor:	*$<listenerID>,CU<cont.update>,<interval>*<checksum><cr><lf>* *$aa,CUcxxxxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,CU?*<checksum><cr><lf>* *$aa,CU?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,CU=<cont.update>,<interval>*<checksum><cr><lf>* *$aa,CU=c,xxxxx*hh<cr><lf>*

Parameters	<continuous update>	
	E	Enabled
	D	Disabled (Factory Default Setting)
	<interval>	
	1 to 59999	interval, in 0.2s increments, between outputs in continuous mode

Examples

Example 1

Set the FT702LM to output readings automatically every 10 seconds. Verify that the command has been accepted.

Message	Comment
$01,CUE00050//<cr><lf>*	Enable CU mode, rate = 0.1Hz

Example 2

Disable the continuous updating. Verify that the command has been accepted. (Note: This command must only be sent during the first four seconds after power-up – for more information see below).

Message	Comment
$01,CUD//<cr><lf>*	Disable CU mode
$01,CU?//<cr><lf>*	Query CU mode setting
*$WI,CU=D,00050*44<cr><lf>*	FT702LM response

Description

Use the CU command to enable or disable the continuous update mode of operation. When continuous update is enabled, the FT702LM will output wind velocity readings at a rate determined by the <interval> setting. The continuous update command should not be used on FT702LM wind sensors with RS485 output enabled.

Each time the continuous update mode is enabled, the required <interval> setting must be sent (even if this has been sent to the FT702LM previously). When the continuous update mode is enabled, if the FT702LM is switched-off, when power is reapplied the FT702LM will automatically resume outputting readings.

Once the FT702LM has been put into continuous update mode then it becomes a talker only and will not respond to any further commands. To be able to send commands again to the FT702LM the continuous mode must be disabled. To achieve this, the CUD (disable continuous update mode) command must be sent within four seconds of the power being applied to the FT702LM.

WARNING: Do not use the continuous update mode if there are other talkers connected to the data bus. Only one active talker is allowed on the data bus at any one time otherwise bus contention will occur

4.3.6 Command: DF Set or query the wind velocity data format

Command Parameter	DF

Command Syntax		
	SET Sensor:	*$<listenerID>,DF<format>*<checksum><cr><lf>* *$aa,DFc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,DF?*<checksum><cr><lf>* *$aa,DF?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,DF=<format>*<checksum><cr><lf>* *$aa,DF=c*hh<cr><lf>*

Parameters	<format>	
	P	Set the data format to Polar (wind speed and direction) (Factory Default Setting)
	N	Set the data format to NMEA 0183

Examples	Example 1 Set the wind velocity output data format to NMEA and verify the new setting.	
	Message	Comment
	$01,DFN//<cr><lf>*	Set format to NMEA
	$01,DF?//<cr><lf>*	Query format setting
	*$WI,DF=N*43<cr><lf>*	FT702LM response

Description	Use the DF command to set the required format of the wind velocity readings. See command WV (3.1.1 & 3.5) for a descriptions of the FT702LM output for each of the format types. Polar Format: The FT702LM returns the magnitude of the wind speed (m/s) and the wind direction (0-359 degrees). See section 4.3.14 for example. NMEA 0183 Format: The FT702LM returns the wind angle (0-359 degrees, Relative) and wind speed (m/s). The FT702LM TalkerID is always set to WI when NMEA format is selected irrespective of any value that may have been set with the ID command. See Section 4.3.15 for example.

4.3.7 Command: DL Set or query the command delay interval

Command Parameter	DL

Command Syntax		
	SET Sensor:	*$<listenerID>,DL<delay>*<checksum><cr><lf>* *$aa,DLxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,DL?*<checksum><cr><lf>* *$aa,DL?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,DL=<delay>*<checksum><cr><lf>* *$aa,DL=xx*hh<cr><lf>*

Parameters	<delay>	
	00 to 20	(delay interval, in 50ms increments) (Factory Default Setting = 01)

Examples	Example 1 Set the command delay interval to 250ms and verify the new setting.	
	Message	Comment
	$01,DL05//<cr><lf>*	Set delay to 250ms
	$01,DL?//<cr><lf>*	Query delay setting
	*$WI,DL=05*02<cr><lf>*	FT702LM response

Description	Use the DL command to set the delay interval from when the FT702LM receives a command to when the command is executed. The DL command is primarily intended for use in systems where a time delay may be required to allow the RS485 host controller interface to switch from transmit to receive mode. For example, if the delay interval is set to 250ms then the FT702LM will output wind velocity data 250ms after receiving a WV command. If any further commands are sent to the FT702LM before the delay interval has elapsed they will be discarded.

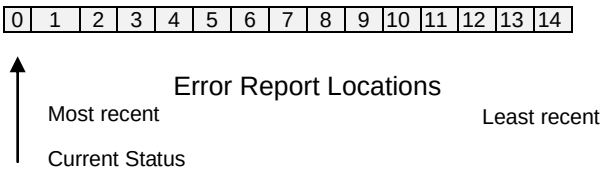
4.3.8 Command: ER query the error report

Command Parameter	ER

Command Syntax		
	SET Sensor:	*$<listenerID>,ER<reset>*<checksum><cr><lf>* *$aa,ERc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,ER?*<checksum><cr><lf>* *$aa,ER?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,ER=<error report>*<checksum><cr><lf>* *$aa,ER=xxxxxxxxxxxxxxx*hh<cr><lf>*

Parameters		
	<reset>	
	R	Resets the historical log section of the error report to all 0's
	<error report>	
	<error report>	FT702LM error report string

Examples		
	Example 1 Query the error report	
	Message	Comment
	$01,ER?//<cr><lf>*	Query error report
	*$WI,ER=000000000000000*28<cr><lf>*	FT702LM response

Description	
	The error report contains information on errors that have occurred during the operation of the FT702LM. The output string is always comprised of 15 ASCII characters (all shown as '0', ASCII 30(HEX) in the above example).  The first character in the data field represents the current operational status of the FT702LM. '0' (ASCII 30(HEX)) indicates that the FT702LM is functioning correctly any other character indicates that an error condition exists. The status is cleared once the ER command is executed. The next 14 locations contain an historical log of the last 14 errors with the most recent error being recorded in the leftmost position. Each error condition is assigned an ASCII character. The historical log is stored in Flash and is retained when the power is switched off or the sensor software reset. This report can be sent back to the FT factory for analysis if there are problems with the sensor

4.3.9 Command: FL Set or query the filter setting

Command Parameter	FL

Command Syntax	SET Sensor:	*$<listenerID>,FL<filter>*<checksum><cr><lf>* *$aa,FLc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,FL?*<checksum><cr><lf>* *$aa,FL?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,FL=<filter>*<checksum><cr><lf>* *$aa,FL=c*hh<cr><lf>*

Parameters	<filter>	
	E	filter enabled (Factory Default Setting)
	D	filter disabled

Examples	Example 1 Enable the filter. Verify that the command has been accepted.	
	Message	Comment
	$01,FLE//<cr><lf>*	Enable filtering
	$01,FL?//<cr><lf>*	Query filter setting
	*$WI,FL=E*40<cr><lf>*	FT702LM response
	Example 2 Disable the filter. Verify that the command has been accepted.	
	Message	Comment
	$01,FLD//<cr><lf>*	Disable filtering
	$01,FL?//<cr><lf>*	Query filter setting
	*$WI,FL=D*41<cr><lf>*	FT702LM response

Description	Use the FL command to enable or disable digital filtering of the wind velocity readings. When the filter is enabled, 8 wind velocity readings are averaged giving an output response time of approximately 1 second.

4.3.10 Command: HT Set or query the heater settings

Command Parameter	HT (enable/ disable)

Command Syntax		
	SET Sensor:	*$<listenerID>,HT<tsp>*<checksum><cr><lf>* *$aa,HTxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,HT?*<checksum><cr><lf>* *$aa,HT?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,HT=<tsp>,<%>,<temp>*<checksum><cr><lf>* *$aa,HT=xx,xx,±xx*hh<cr><lf>*

Parameters		
	<tsp> *00-44* *99*	heater control circuit set point temperature (degrees centigrade) disables the heater (factory default setting)
	<%> *00-99*	read only parameter that returns the % of full scale heater current limit 0% (heater off) to 99% (heater fully on)
	<temp> *-99 to +99*	read only parameter that returns the current internal temperature of the FT702LM, In ºC, in range 00 to ±99ºC

Examples

Example 1

Set the FT702LM set point temperature to 5°C. Verify that the command has been accepted.

Message	Comment
$01,HT05//<cr><lf>*	*Set heater set point temp*
$01,HT?//<cr><lf>*	*Query heater setting*
*$WI,HT=05,00,+24*3B<cr><lf>*	*FT702LM response*

Example 2

Turn off the FT702LM heater. Verify that the command has been accepted.

Message	Comment
$01,HT99//<cr><lf>*	*Disable heater*
$01,HT?//<cr><lf>*	*Query heater setting*
*$WI,HT=99,00,+24*3E<cr><lf>*	*FT702LM response*

Description

Use the HT command to set the heater parameters. Including switching the heater on or off and configuring the heater set point. It is possible to query the sensor's internal temperature. It is also possible to query the duty cycle of the heater, which specifies the percentage of the current being drawn by the heaters.

4.3.11 Command: ID Set or query the Listener and Talker Identifiers

Command Parameter	ID

Command Syntax		
	SET Sensor:	*$<listenerID>,ID<RxID><TxID>*<checksum><cr><lf>* *$aa,ID=cccc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,ID?*<checksum><cr><lf>* *$aa,ID?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,ID=<RxID><TxID>*<checksum><cr><lf>* *$aa,ID=cccc*hh<cr><lf>*

Parameters		
	<RxID>	
	00 to ZZ	The FT702LM 2 digit listener address identifier
	<TxID>	
	00 to ZZ	The FT702LM 2 digit talker address identifier

Examples

Example 1

Set the FT702LM listener address identifier to A1 and the talker address identifier to B1. Verify that the command has been accepted.

Message	Comment
$01,IDA1B1//<cr><lf>*	Set address ID's
$A1,ID?//<cr><lf>*	Query ID settings
*$B1,ID=A1B1*6C<cr><lf>*	FT702LM response

Note: the ID? command must use the new listener ID otherwise the command will not be recognised.

Description

Use the ID command to set the listener and talker address identifiers. See Section 4.2.4 for information on listener and talker address identifiers.

4.3.12 Command: MM Reset or query the min/max recorded wind speed

Command Parameter	MM

Command Syntax	SET Sensor:	*$<listenerID>,MM<setting>*<checksum><cr><lf>* *$aa,MMc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,MM?*<checksum><cr><lf>* *$aa,MM?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,MM=<MinSpeed>,<MaxSpeed>*<checksum><cr> <lf>* *$aa,MM=xxx.x,xxx.x*hh<cr><lf>*

Parameters	<setting>	
	R	resets the min/max readings to their default (<MinSpeed> to 999.9 and <MaxSpeed> to 000.0) until the first reading
	<MinSpeed>	
	000.0 to 999.9	minimum detected wind speed in m/s
	<MaxSpeed>	
	000.0 to 999.9	maximum detected wind speed in m/s

Examples	Example 1	
	Query the min/max wind speed readings	
	Message	Comment
	$01,MM?//<cr><lf>*	Query the min/max readings
	*$WI,MM=005.1,034.2*22<cr><lf>*	FT702LM response

Description	Use the MM command to query the minimum and maximum wind speed readings that the FT702LM has recorded since it was last switched on. The minimum and maximum readings are set to their default values when an MMR or RS command is sent.

4.3.13 Command: RS Reset the FT702LM

Command Parameter	RS

Command Syntax	SET Sensor:	*$<listenerID>,RS<mode>*<checksum><cr><lf>* *$aa,RSc*hh<cr><lf>*
	QUERY Sensor:	*NA*
	FT702LM output:	*None*

Parameters	<mode>	
	F	reset the FT702LM, loading the factory default settings
	U	reset the FT702LM, reloading the user parameter settings

Examples	Example 1 Reset the FT702LM, reloading the last parameter settings	
	Message	Comment
	$01,RSU//<cr><lf>*	Reset sensor, reloading last settings

Description	Use the RS command to reset the FT702LM software. The sensor will be ready to receive new commands or take readings from a maximum of 1 second after any reset command is sent. To restart the software, but continue to use the pervious user parameter settings use the RSU command To restart the software, but load the factory default parameter settings use the RSF command After RSF command is executed, it is imperative to execute any one of the Set Commands. Executing any one of these commands instructs the sensor to make a non-volatile copy of the newly created User Parameters.

4.3.14 Command: WV Polar: Query the wind velocity reading

Command Parameter	WV (Polar)

Command Syntax		
	SET Sensor:	N/A
	QUERY Sensor:	*$<listenerID>,WV?*<checksum><cr><lf>* *$aa,WV?*hh<cr><lf>*
	FT702LM output:	*$<talkerID>,WVP=<speed>,<angle>,<status>*<checksum><cr><lf>* *$aa,WVP=xxx.x,xxx,x,0*hh<cr><lf>*

Parameters		
	<speed> *000.0 to 050.0*	measured wind speed in meters per second
	<angle> *000.0 to 359.9*	measured wind direction in degrees relative to FT702LM datum
	< status > *0 to Z*	Indicates whether an error condition was detected by the operating system, such as out of range wind speed or incorrect signal level. Any character other than '0' (ASCII 30(HEX)) = error

Examples	
	Example 1 The following example illustrates the polar wind velocity data format. The example shows the FT702LM output with a wind speed of 20m/s and a wind angle of 45deg.
	Message: *$01,WV?*//<cr><lf>* — Comment: Query the wind velocity
	*$WI,WVP=020.0,045,0*73<cr><lf>* — FT702LM polar response

	The WV command returns the wind velocity value in the currently selected format. Polar or NMEA formats are available. Use the DF command, Section 4.3.6, to select the required output format. Polar Format: The FT702LM returns the magnitude of the wind speed (m/s) and the wind direction (0-359.9 degrees).

It is recommended that the status is always monitored. The status is cleared once the WV command is executed, provided that the error condition does not persist.

4.3.15 Command: WV NMEA: Query the wind velocity reading

Command Parameter	WV (NMEA)

Command Syntax		
	SET Sensor:	N/A
	QUERY Sensor:	*$<listenerID>,WV?*<checksum><cr><lf>* *$aa,WV?*hh<cr><lf>*
	FT702LM output:	*$WIMWV,<angle>,R,<speed>,M,<status>*<checksum><cr><lf>* *$WIMWV,xxx,R,xxx.x,M,A*hh<cr><lf>*

Parameters		
	<speed> *000.0 to 050.0*	measured wind speed in meters per second
	<angle> *000 to 359*	measured wind direction in degrees relative to FT702LM datum
	< status > *0 to Z*	Indicates whether an error condition was detected by the operating system, such as out of range wind speed or incorrect signal level. Any character other than 'A' (ASCII 41(HEX)) = error

Examples	
	Example 2 The following example illustrates the NMEA wind velocity data format. The example shows the FT702LM output with a wind speed of 20m/s and a wind angle of 45deg.
	Message: *$01,WV?*//<cr><lf>* — Comment: Query the wind velocity
	*$WIMWV,045,R,020.0,M,A*3D<cr><lf>* — FT702LM NMEA response

	The WV command returns the wind velocity value in the currently selected format. Polar or NMEA formats are available. Use the DF command, Section 4.3.6, to select the required output format. NMEA 0183 Format: The FT702LM returns the NMEA 0183 Wind Speed and Angle sentence MWV. (See WV NMEA, Section 3.5) The FT702LM returns the wind direction (0-359 degrees) and wind speed (m/s) using the MWV Wind Speed and Angle sentence. The FT702LM Talker ID is always set to WI when NMEA format is selected, irrespective of any setting that may have been set with the ID command.

It is recommended that the status is always monitored. The status is cleared once the WV command is executed, provided that the error condition does not persist.

4.4 FT702LM Quick Start Guide

The FT702LM can be easily connected to any PC or terminal fitted with a RS422 or RS485 compatible serial port. Follow the steps below to try out the FT702LM (see Figure 4 for connector pin designations):

1. Connect a dc supply (4.4-30V) to the supply pins of the FT702LM connector.

2. For LM1&2 Connect the Data 'A' and Data 'B' transmitter outputs of the PC/RS422 converter to Rx Data 'A' and Rx Data 'B' pins on the FT702LM connector. Connect the Data 'A' and Data 'B' receiver inputs of the PC/RS422 converter to Tx Data 'A' and Tx Data 'B' pins on the FT702LM connector.

   For RS485 output connect the Data 'A' and Data 'B' pins of a PC/RS485 converter to the Data 'A' and Data 'B' pins on the FT702LM connector.

3. Most terminal emulator programs (such as Windows HyperTerminal) can be used to communicate with the FT702LM. Set the Com Port parameters as follows:

   Baud rate = 9600
   Data bits = 8
   Start bits = 1
   Stop bits = 1
   Parity = none
   Flow control = none

   As the FT702LM does not echo received characters the terminal 'local echo' should be set to 'on'. For the FT702LM to recognise a command, the command string must be terminated with a carriage return <cr> and a line feed character <lf>. Ensure that the terminal program is set to terminate transmitted strings with both a <cr> and <lf>.

4. Commands can now be typed in on the terminal. For example, to read back the current wind velocity type in:

   $//WV?//*

   and then press <return> to send the command.

   The FT702LM will respond with:

   *$01,WVP=xxx.x,xxx,c*hh*

   where xxx.x is the wind speed in metres per second, xxx is the wind direction in degrees and c is the status (0 indicates a valid reading). The 2 characters after the '*' character are the message checksum value which can be ignored for the time being.

   To output wind velocity readings automatically at a rate of 1 per second, type in the following command:

   $//CUE=00005//*

   and then press <return> to send the command.

   To return to 'on demand' mode type in:

   $//CUD//*

   See Section 4.3 for a full list of commands and information on the FT702LM message protocol.

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