SMART WEIGHING SOLUTIONS

T-Series Modules

(T610, T620, T105)

Reference Manual

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Table of Contents

1. Introduction

The T6xx modules are digital weight transmitters that use the rinWIRE interface which implements RS485 serial communication protocol to connect devices in a ring network.

Digital weight Transmitters are used to connect load cells into the rinWIRE network and transmit the weights according to the protocol that uses ASCII characters with a single master POLL / RESPONSE message structure.

As all the devices in rinWIRE network must use the same serial communications signals. The T-Series Interface converters are used to convert the RS232 serial signals to the RS485 serial signals.

1.1. Digital Weight Transmitters

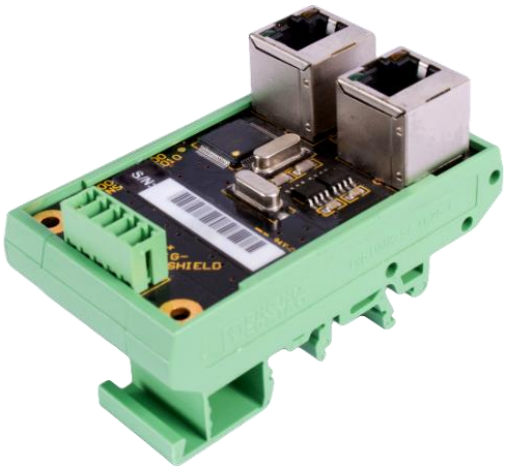


Figure 1 - T610

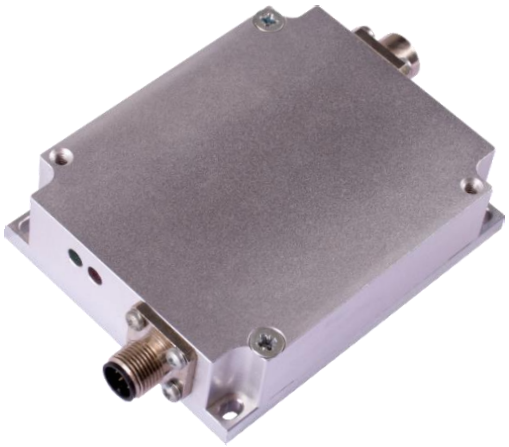


Figure 2 - T620

1.2. RinWIRE interface converters

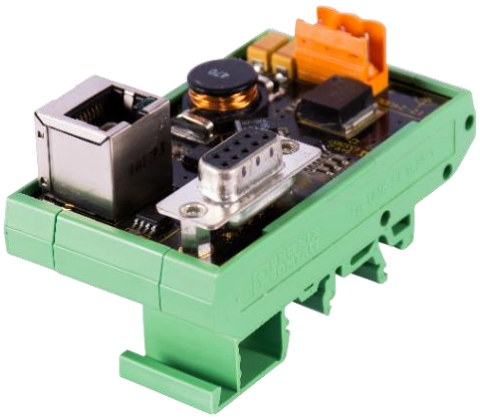


Figure 3 - T105

1.3. Overview

The T-series modules use the rinWIRE digital interface which has the following characteristics:

- Uses standard RS485 serial communications signals.
- RJ45 connectors are supported for internal applications, M12 waterproof connections are recommended for outdoor waterproof applications.
- All connections are made with straight through 8-way cat5 ethernet cable wired according to the standard Power-over-Ethernet standard.
- Power is provided to the modules through the cable and ranges from 7 to 15Vdc.
- Each sensor regenerates the communication signals so there is no need for network termination devices to balance the network as with standard RS485.
- rinWIRE supports both individually addressed communications and broadcast messages. Due to its unique architecture devices do not need to have unique addresses when first added to the network.
- Provision is made for synchronization of all devices on the network.
- Up to 31 devices can be connected to the rinWIRE network.
- The rinWIRE network presents to the host controller as a single multi-channel device. Broadcast queries can be issued which collect responses from all units in a single transaction.
- rinWIRE supports ring, tree and star network configurations due to the unique connection details within each connection device. In all cases standard straight through Cat5 cable is all that is required

1.4. RINSTRUM R300 viewer connection (T610 & T620)

Figure 4 - T6xx connected with RINSTRUM R300 viewer.

More than just Digital weight transmitters the T610/T620 can be connected to the RINSTRUM R300 Viewer, which enables the following:

- Get weight displayed.
- Can do calibrations for the loadcells: mV/V factory calibration or direct mV/V or test weight calibration.
- Virtual access for Zero, Tare and Gross/Net keys.
- Standard weight status like Overload, Underload, Error, Motion, Centre of Zero, and Zero Band are displayed which enables simple scale functionality possible.

1.4.1. Methods to connect to viewer

Using RS485 to USB converter:

- Connect T610/T620 to the RS485 to USB converter with appropriate connections (refer sections 3.1 and 3.2 for pin diagrams).
- If the RS485 to USB converter don't have a built-in power supply, powerup the Digital weigh transmitters using an external power supply.

Using T105 and RS232 to USB converter:

- Connect the T610/T620 to T105's RJ45 port with appropriate cabling.
  - T610: cat5 patch cable.
  - T620: 8pin M12 connector to RJ45 connector (refer sections 3.1 and 3.2 for pin diagrams).
- Use a RS232 to USB converter to connect T105 with PC.
- External power supply for T105.

Using T105 and directly connecting to a PC with RS232 serial port:

- Connect the T610/T620 to T105 as mentioned above.
- Connect the T105's RS232 serial port with the PC's RS232 serial port directly.

1.4.2. Serial configuration

- Baud Rate : 9600
- Data Bits : 8
- Parity : None
- Stop Bits : 1

2. Specifications

2.1. Specification Table Digital Weight Transmitters

	T610	T620
Resolution	min 0.25 µV/division	
Zero Cancellation	±2.0 mV/V	
Span Adjustment	0.1mV/V to 3.0mV/V full scale	
Excitation	5VDC for up to 4 x 350 ohm loadcells	
A/D Type	24 Bit Sigma Delta – 8,388,608 internal counts	
Operating Environment	Compensated: –10°C to +50°C Operating: –20°C to +60°C	
Digital Filter	FIR: 80 dB, FIFO: 100 sample	
Conversion Rate	20-100 Hz	
Stability/Drift	Zero: < 0.1 µV/ºC (+ 8ppm of deadload max) Span < 8 ppm/ºC, Linearity < 20ppm, Noise < 0.2 µVp-p	
Power input	7 – 15 Vdc in (Power-over-Ethernet standard)	
Interfaces	Serial In\Out: RJ45 Load cell: 5 pin Dinkle connector	Loadcell - 5 pin M12 connector Serial Conn. - 8 pin M12 connector
Dimensions	77 x 44.9 x 42 mm 3.03 x 1.76 x 1.65 in	129 x 80 x 26 mm 5.07 x 3.15 x 1.02 in
Weight	60g 2.11 oz	440g 15.52 oz
Mounting	DIN Rail mounting	Wall mounting
Case Materials	Polyamide	Aluminum
	Indicator Application Software	
Resolution	Max 60,000 weight divisions	
Virtual Keys	Zero, Tare, Gross/Net	
Weight Status	Overload, Underload, Error, Motion, Centre-of-Zero, Zero Band	
Virtual LCD Interface	RINSTRUM R320 Emulation	
Virtual Setpoint	2	
Calibrations	mV/V Factory Calibration, Direct mV/V calibration commands, Test Weight calibration commands	

Specifications are subject to variation for improvement without notice - Illustrations are indications only and variation may be evident between products

2.2. Specification Table rinWIRE interface converter

	T105
Power	12-24VDC in, 7.4 VDC out at 2A Reverse Polarity and short circuit protected
Serial Interface	Convert Standard RS232 to Rs485
Connectors	RS232 – DB9-F serial connector RS485 – RJ45 connector
Operating Environment	Compensated: –10°C to +50°C Operating: –20°C to +60°C
Dimensions	77 x 44.9 x 42 mm 3.03 x 1.76 x 1.65 in
Weight	60g 2.11 oz
Mounting	DIN Rail mounting
Case Materials	Polyamide

3. Pin Diagrams

3.1. Digital Weight Transmitter T610

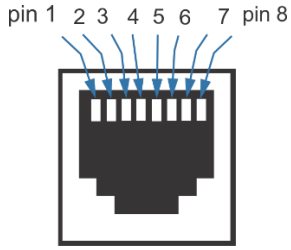


Figure 5 - RJ45 output Female port [Front]

Pin No	Description
1	TXA
2	TXB
3	RXA
4	V+
5	V+
6	RXB
7	V-
8	V-

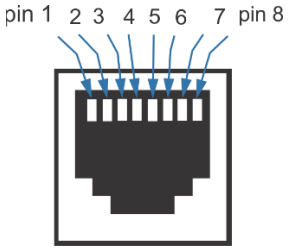


Figure 6 - RJ45 input Female port [Front]

Pin No	Description
1	RXA
2	RXB
3	TXA
4	V+
5	V+
6	TXB
7	V-
8	V-

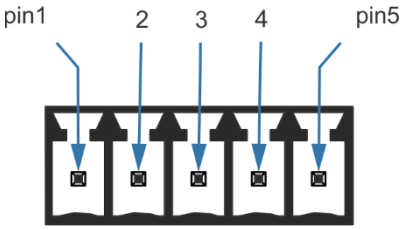


Figure 7 - loadcell Female connector [Front]

Pin No	Description
1	AN-EX+
2	AN-EX-
3	AN-SIG+
4	AN-SIG-
5	SHIELD

3.2. Digital Weight Transmitter T620

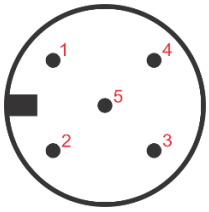


Figure 8 - M12 Analog Loadcell Male Socket

Pin No	Description
1	AN-EX+
2	AN-SIG+
3	AN-EX-
4	AN-SIG-
5	SHIELD

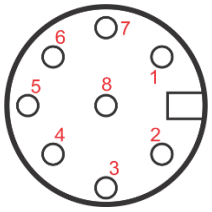


Figure 9 - M12 rinWIRE Out Plug

Pin No	Description
1	TXA
2	TXB
3	RXA
4	V+
5	V+
6	RXB
7	V-
8	V-

3.3. rinWIRE Interface Converter T105

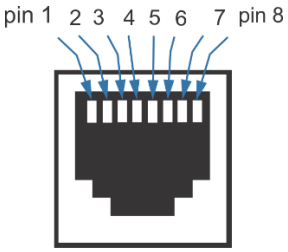


Figure 10 - RJ45 output

Female port

Pin No	Description
1	TXA
2	TXB
3	RXA
4	V+
5	V+
6	RXB
7	V-
8	V-

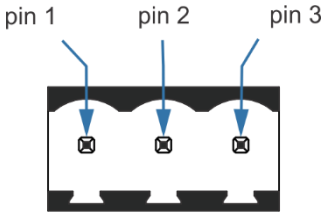


Figure 11 - DC input

male socket

Pin No	Description
1	V+
2	V-
3	GND

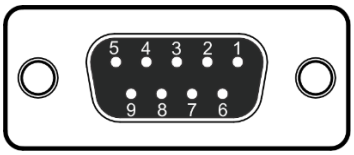


Figure 12 - DB9 (RS232) Female port

Pin No	Description
1	NC
2	RS232 TX
3	RS232 RX
4	NC
5	RS232 GND
6	RS232 TXB-
7	RS232 TXA+
8	RS232 RXB-
9	RS232 RXA+

4. rinWIRE communication Cabling System

4.1. T610 connections.

4.1.1. rinWIRE connector

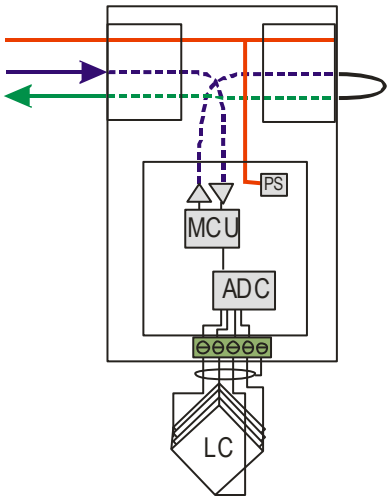


Figure 13 - rinWIRE Connector

4.1.2. Simple connection

T-series modules can be connected together to form a simple ring structure with the return path built into the cabling as follows:

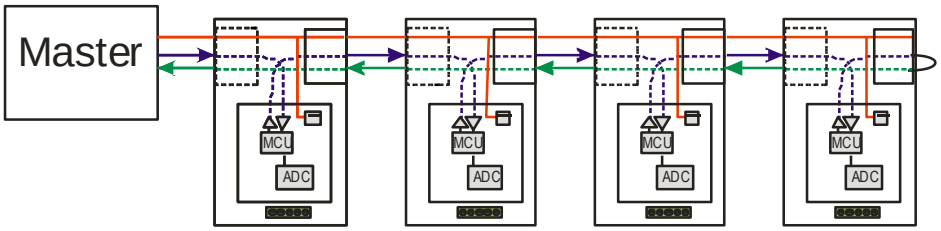


Figure 14 - simple rinWIRE network

Note that the loopback connection on the last connection in the chain.

4.2. T620 connections.

4.2.1. rinWIRE T-Junction

Network can also be split into a number of connection chains using the rinWIRE T-junction:

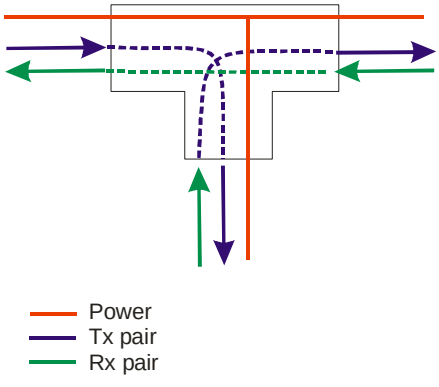


Figure 15 - rinWIRE T-Junction

4.2.2. Custom connection chains can be built using rinWIRE T-junction.

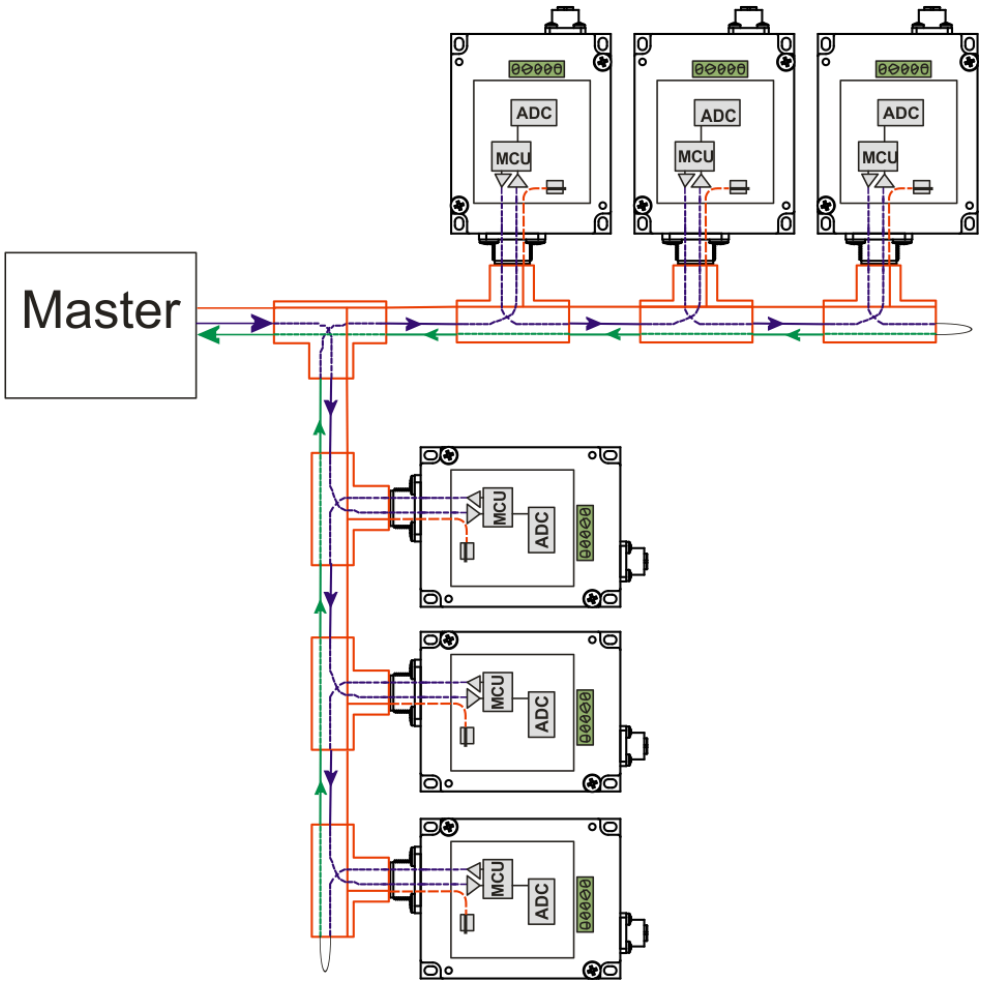


Figure 16 - Custom network of T620 using rinWIRE T-junction

5. Protocol Overview

The protocol uses ASCII characters with a single master POLL / RESPONSE message structure. All information and services are provided by registers each of which has its own register address.

5.1. Basic Message Format

The basic message format is as follows:

ADDR	CMD	REG	:	DATA
Header				*Data*

5.1.1. ADDR

ADDR is a two character hexadecimal field corresponding with the following:

ADDR	Field Name	Description
80_H	Response	'0' for messages sent from the master (POLL). '1' for messages received from a module (RESPONSE)
40_H	Error	Set to indicate that the data in this message is an error code and not a normal response.
20_H	Reply Required	Set by the master to indicate that a reply to this message is required by any slave that it is addressed to. If not set, the slave should silently perform the command.
00_H .. $1F_H$	Module Address	Valid addresses are 01_H to $1F_H$ (1 .. 31). 00_H is the broadcast address. All sensors must process broadcast commands. When replying to broadcasts, sensors reply with their own address in this field.

Note: The hexadecimal codes are combined in the fields described above when multiple options are active at the same time. For example, an error response message from sensor address 5 would have an ADDR code of $C5_H$ ($80_H + 40_H + 05_H$).

5.1.2. CMD

CMD is a two character hexadecimal field:

CMD	Command	Description
05_H	Read Literal	Read register contents in a 'human readable' format
11_H	Read Final	Read register contents in a hexadecimal data format
16_H	Read Final (Decimal)	Same as Read Final except numbers are decimal.
12_H	Write Final	Write the DATA field to the register.
17_H	Write Final (Decimal)	Same as Write Final except numbers are decimal.
10_H	Execute	Execute function defined by the register using parameters supplied in the DATA field.

5.1.3. REG

REG is a four character hexadecimal field:

REG	Register	Description
0004_H	Software Version	Returns software version number
0005_H	Serial Number	Returns sensor serial number
0010_H	Save settings	Execute register to save all settings
$001F_H$	Save status	Execute register to save user zero and tare/PT values, gross/net status.
0020_H	ADC Sample Number	Read current sample number since last power on. (32 bit)
0021_H	System Status	This register can be read to obtain the status of the instrument. 32 status bits sent as 8 hex chars, where: 00020000_H: Overload 00010000_H: Underload 00008000_H: Error (see System Error) 00004000_H: SETUP menus active 00002000_H: Calibration in progress 00001000_H: Motion 00000800_H: Centre of Zero 00000400_H: Zero 00000200_H: Net 00000080_H: Setpoint 1 status 00000040_H: Setpoint 2 status
0022_H	System Error	Diagnostic Errors
0023_H	Absolute mV/V	Absolute mV/V reading where 10000 = 1.0mV/V
0025_H	Displayed Weight	Gross or Net weight depending on which is active
0026_H	Gross Weight	Gross weight
0027_H	Net Weight	Net weight

0028_H	Tare Weight	Tare weight
$002E_H$	Pre-set Tare Weight	pre-set Tare weight
$014A_H$	Auto Address	Execute register without <DC2> <DC4> framing to set the address based on ring network position.

5.1.4. :DATA

:DATA carries the required information for the message

:	':' (COLON) character is used to separate the header (ADDR CMD REG) and DATA information.
DATA	Carries the information for the message. Some messages require no DATA (eg Read Commands) so the field is optional.

5.2. Termination

Message termination is possible in two ways.

1. ↵ : For normal communications use either a CRLF (ASCII 13, ASCII 10) as a terminator or a semicolon (';' ASCII). There is no start-of-message delimiter:

   <Message>↵

2. To use framing the message is framed as:

   STX <Message> **ETX**

STX	ASCII 02
	Message as above, CRLF or semicolon termination can be included but are not necessary.
ETX	ASCII 03

5.3. Error Handling

If a command cannot be processed, the sensor returns an error. The ERROR bit in the ADDR field is set and the DATA field contains the Error Code as follows:

Error	DATA	Description
Unknown Error	$C000_H$	Error is of unknown type
Not Implemented Error	$A000_H$	Feature not implemented on this device
Access Denied	9000_H	Passcode required to access this register
Data Under Range	8800_H	Data too low for this register
Data Over Range	8400_H	Data too high for this register
Illegal Value	8200_H	Data not compatible with this register
Illegal Operation	8100_H	CMD field unknown
Bad parameter	8040_H	Parameter not valid for this execute register
Menu in Use	8020_H	Cannot modify register values while SETUP menus are active
Viewer Mode required	8010_H	Advanced operation chosen which requires the sensor to be in viewer mode.
Checksum required	8008_H	A checksum is required for the chosen command.

5.4. Overall Communication Framing

In the general case when more than one sensor is connected on a RING network it is necessary to frame the message using special framing characters **<DC2>** and **<DC4>.**

<DC2> and **<DC4>** are the characters ASCII 12_H and ASCII 14_H respectively, here called 'Echo-On' and 'Echo-Off'.

Upon receiving the **<DC2>** character the sensor begins echoing all received characters at the hardware level.

The **<DC4>** character halts the communications echo of incoming characters and provides an opportunity for the sensor to insert its response to the command. The sensor transmits any response it has and then appends a new **<DC4>** character.

The following example shows a complete POLL RESPONSE transaction for a network of two sensors. Note that the sensors adopt the message termination and framing of the POLL command. In this case framing is required but if the simple message termination of a CRLF was used instead the framing would not be used either by the Master or the sensors.

Sent from Master:

<DC2>

STX <Read Weight> **ETX**

<DC4>

Received at master:

<DC2>

STX <Read Weight> **ETX**

STX <Sensor 1 Weight> **ETX**

STX <Sensor 2 Weight> **ETX**

<DC4>

Note that the Master receives its original poll command back along with the responses from all addressed sensors within the **<DC2>** **<DC4>** framing.

6. Appendix – Examples

	Description
Read Gross Weight (Read Final) **COMMAND:** « 21110026:↵ » **RESPONSE:** « 21110026:↵ 81110026:00000064↵ »	**COMMAND:** Read Gross Weight (Register 0026): ADDR = 21_H: Reply required only from sensor 1 CMD = 11_H: Read Final REG = 0026_H: Gross Weight **RESPONSE:** Response is from instrument #1 which currently has a Gross weight of 64_H = 100 kg.
Read Gross Weight (Read Literal) **COMMAND:** « 21050026:↵ » **RESPONSE:** « 21050026:↵ 81050026: 100 kg G↵ »	**COMMAND:** Read Gross Weight (Register 0026_H): ADDR = 21_H : Reply required only from sensor 1 CMD = 05_H : Read Literal REG = 0026_H : Gross Weight **RESPONSE:** Same response from instrument #1 but in literal format.
Read Gross Weight (Read Literal) **COMMAND:** «20050026:↵ » **RESPONSE:** « 20050026:↵ 81050026: 100 kg G↵ 82050026: 125 kg G↵ »	**COMMAND:** Read Gross Weight (Register 0026_H): ADDR = 20_H : Reply required from all sensors CMD = 05_H : Read Literal REG = 0026_H : Gross Weight **RESPONSE:** Same response from instrument #1 but now instrument #2 answers with a weight of 125 kg as well.
Auto set Address (Execute) **COMMAND:** 2010014A:1↵ **RESPONSE:** 2010014A:3↵	**COMMAND:** Auto set address (Register $014A_H$): ADDR = 20_H : Reply required from all sensors CMD = 10_H : Execute REG = $014A_H$: Auto set address DATA = 1: start address **RESPONSE:** Same command but now the start address is 1 higher than the last instrument. In this case there are two instruments that have been assigned the addresses 1 and 2 based on their position in the ring with respect to the master.
Set Preset Tare Weight (Write Decimal) **COMMAND:** « 2117002E:20↵ » **RESPONSE:**	**COMMAND:** Set Preset Tare Weight (Register $002E_H$): ADDR = 21_H : Write and Reply required only from sensor 1 CMD = 17_H : Write Decimal

« 2117002E:20↵ 8117002E:0000↵ »	REG = $002E_H$: Preset Tare Weight DATA = 20: 20 kg Preset Tare value **RESPONSE:** Instrument #1 writes the Preset Tare value and returns that there were no errors.
Save status (Execute) **COMMAND:** «2010001F:↵ » **RESPONSE:** « 2010001F:↵ 8110001F:0000↵ 8210001F:0000↵ »	**COMMAND:** Execute save status (Register $001F_H$): ADDR = 20_H : Execute and Reply required from all sensors CMD = 10_H : Execute REG = $001F_H$: Save status **RESPONSE:** Instrument #1 and instrument #2 both save status and reply that there were no errors.

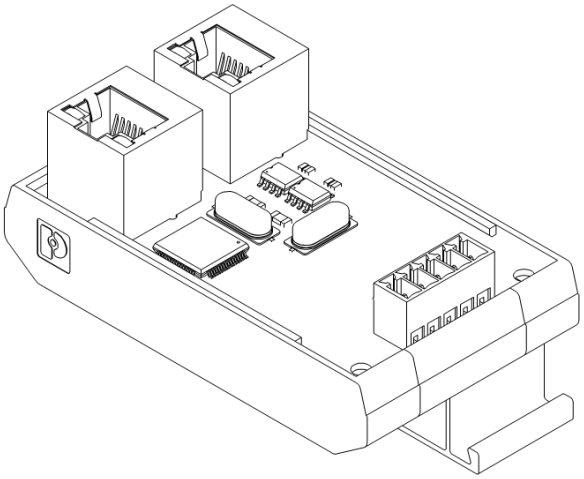
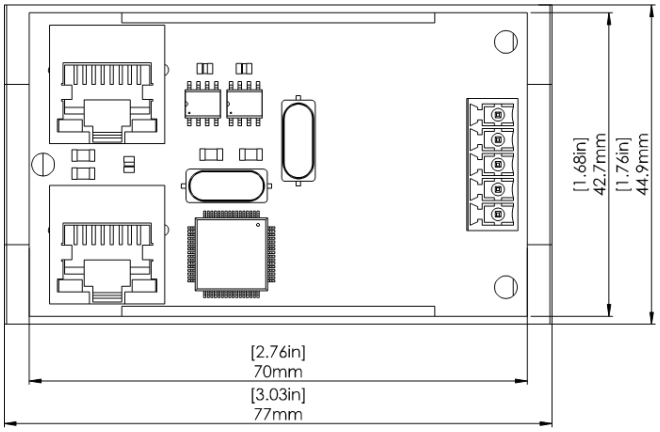
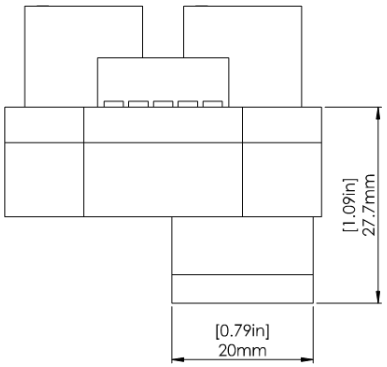
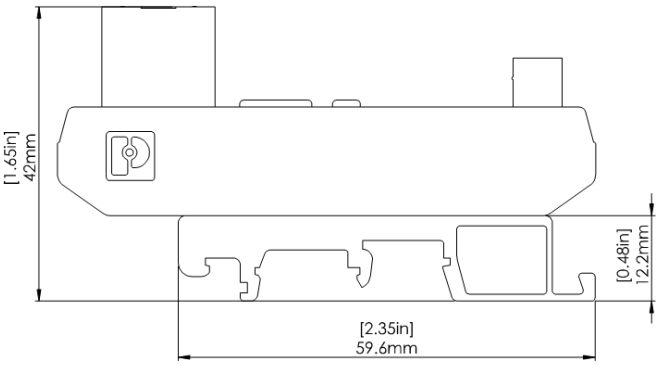
where

« is **<DC2>**

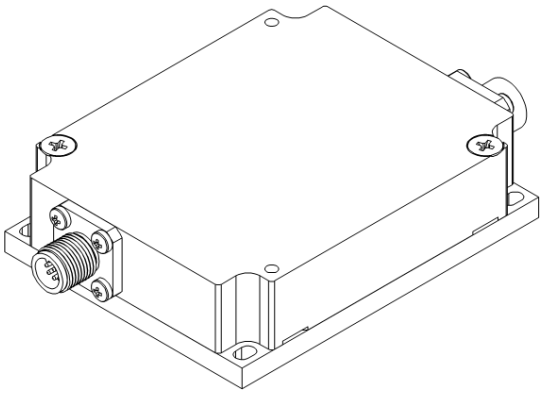
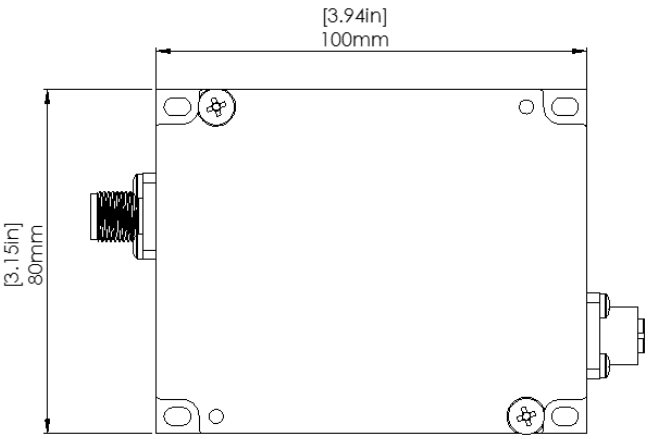
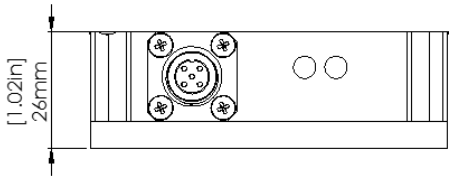
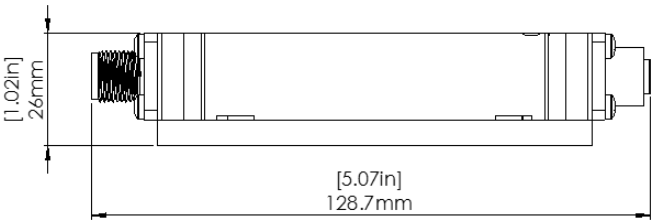
↵ is message termination CRLF or ';'

» is **<DC4>**

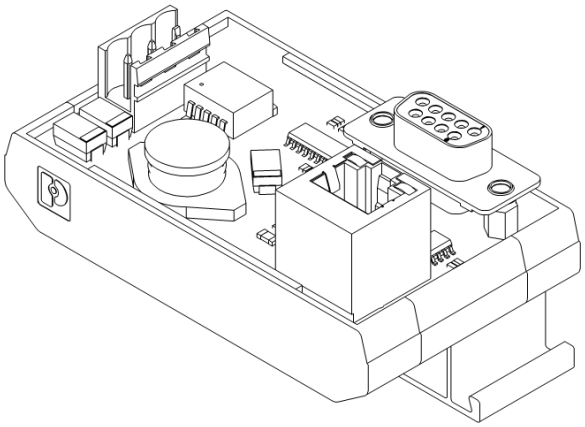
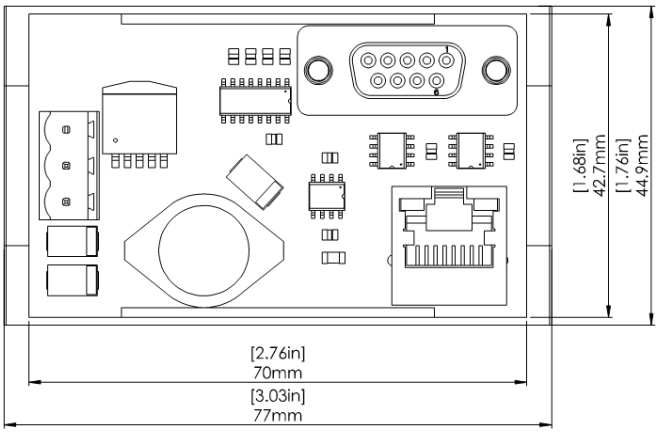
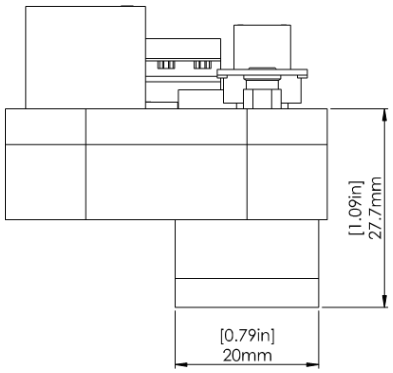
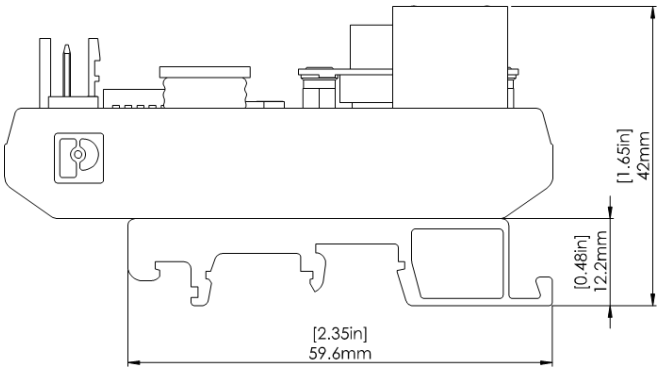
7. Appendix – T610 Dimensions

Digital Weight Transmitter	1 inch = 25.4 mm
3D View	**Top View**
	
Front View	**End View**
	

8. Appendix – T620 Dimensions

Digital Weight Transmitter	1 inch = 25.4 mm
3D View 	**Top View** 
Front View 	**End View** 

9. Appendix - T105 Dimensions

rinWIRE Interface converter	1 inch = 25.4 mm
3D View	**Top View**
	
Front View	**End View**
	

10. Glossary Terms

Term	Definition
COMM	The communications protocol used to communicate with the R300 Series
Count-by	The smallest change in weight units that the display can show. See also Resolution.
Division	A single graduation.
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMC	Electro-Magnetic Compatibility Regulation
FIR	Finite Impulse Response
Full Scale	The maximum gross weight allowed on the scale. This is used to detect overload and underload conditions, etc.
Graduations	The maximum number of display steps between zero gross load and full capacity gross load. It is equal to the full scale divided by the resolution.
LED	Light Emitting Diode
NTEP	National Type Evaluation Program
OIML	International Organization of Legal Metrology
opto-LINK Cable	opto-isolated infrared communications link cable
PLC	Programmable Logic Controller
Range	Total change in weight between zero gross load and full capacity gross load (ie. the nominated total capacity of the scale). It is always given in displayed weight units.
Resolution	The smallest change in weight units that the display can show. See also Count-by.
RFI	Radio Frequency Interference
Ring Network	A network of up to 31 Instruments connected to a central computer
RS-232	Standard for communications hardware layers.
Step-Response	The step-response is the time between placing a weight on the scale and the correct weight reading being displayed.
Transients	A temporary voltage oscillation or spike caused by a sudden change of load (or other external influence).
Units	The actual units of measurement (kilograms, tonnes, pounds, etc.).

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