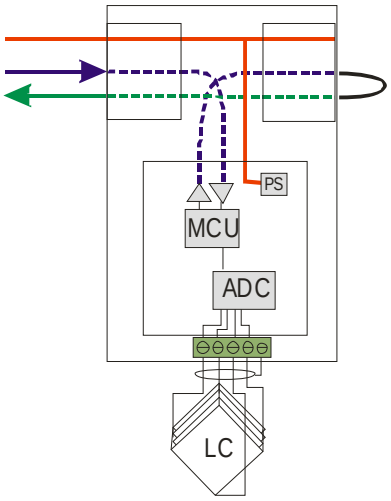
Technical Reference

T-series Modules

1. Overview

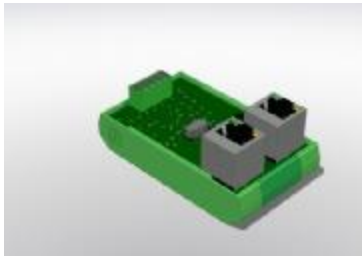
1.1. The T-series modules use the rinWIRE digital interface which has the following characteristics:

- 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.



2. T-series Modules

2.1. T610 Weight Transmitter



Hardware

A/D	24 Bit Sigma Delta – 8,388,608 internal counts
Conversion rate	20-100 Hz
Filter	FIR: 80 dB, FIFO: 100 sample
Resolution	min 0.25µV/division
Zero Cancellation	±2.0mV/V
Span Adjustment	0.1mV/V to 3.0mV/V full scale
Excitation	$5V_{DC}$ for up to 4 x 350 ohm loadcells
Operating Environment	Compensated: -10 to 50 degrees C Operating : -20 to +60 degrees C
Stability/Drift	Zero: < 0.1µV/°C (+ 8ppm of deadload max) Span < 8 ppm/°C, Linearity < 20ppm, Noise < 0.2µVp-p

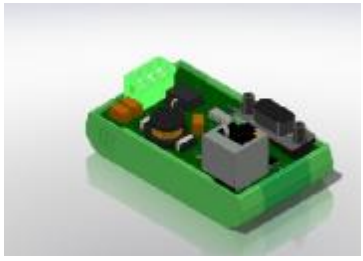
Indicator Application Software:

Resolution	Max 60,000 weight divisions
Virtual Keys	Zero, Tare, Gross/Net
Weight Status	Overload, Underload, Hardware Error, Motion, Centre-of-Zero, Zero Band,
Virtual LCD Interface	Rinstrum R320 Emulation
Features	mV/V Factory Calibration, Direct mV/V calibration commands, Test Weight calibration commands, OIML, NTEP Trade application functionality Zero-on-Startup, Zero Tracking

Custom Application Software:

Interface	ANSI C
Memory	56k Flash Memory, 4k RAM
API Libraries	A/D interface, serial communications, System timers, Flash data access,

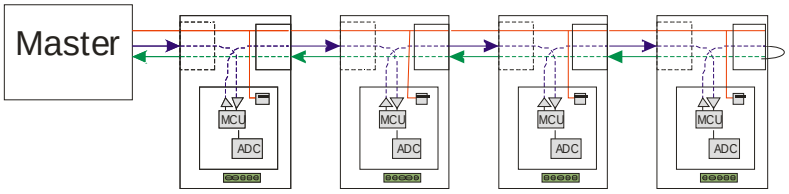
2.2. T105 Protocol Board



Power	12-24V_{DC} in, 7.4 V_{DC} out at 2A Reverse Polarity and short circuit protected
Serial Interface Conversion	RS232 in

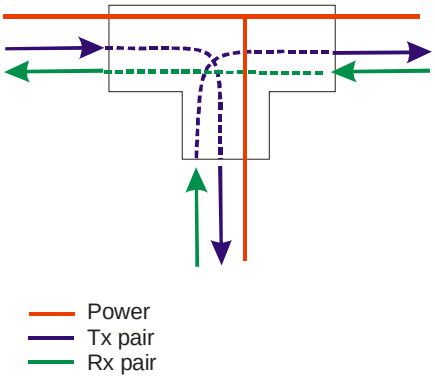
3. rinWIRE Communications Cabling System

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

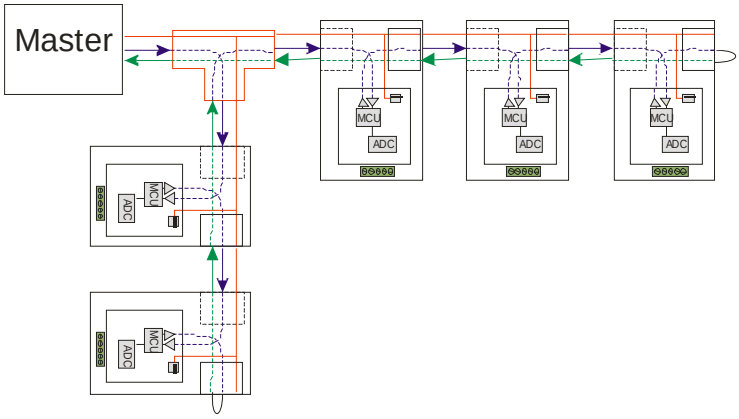


Note that the loopback connection on the last connection in the chain.

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



3.3. Various network configurations can be created using a combination of T-junctions:



4. 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.

4.1. Basic Message Format

The basic message format is as follows:

ADDR	**CMD**	**REG**	**:**	**DATA**
Header				*Data*

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 $C5_H$ ($80_H + 40_H + 05_H$).

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.

REG is a four character hexadecimal field:

REG	Register	Description
0005_H	Serial Number	Returns sensor serial number
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
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 0027_H 0028_H	Gross,Net,Tare Weight	Gross Net or Tare weights

: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.

4.2. Termination

Message termination is possible in two ways.

1. 8 : For normal communications that do not involve checksums use either a CRLF (ASCII 13, ASCII 10) as a terminator or a semicolon (';' ASCII). There is no start-of-message delimiter:

   <Message> 8

2. To use a checksum the message is framed as:

   SOH <Message> ***CRC*** **EOT**

SOH	ASCII 01
CRC	a 4 character hexadecimal field comprising the 16 bit CRC checksum. The CRC uses the 16 bit CCITT polynomial calculation and includes only the contents of the <Message> section of the transmission.
EOT	ASCII 04

4.3. 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.

Table 1: Network error codes

4.4. 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 checksum requirement of the POLL command. In this case a full checksum is required but if the simple message termination of a CRLF was used instead the checksums would not be generated either by the Master or the sensors.

Sent from Master:

<DC2>

SOH <Read Weight> ***CRC*** **EOT**

<DC4>

Received at master:

<DC2>

SOH <Read Weight> ***CRC*** **EOT**

SOH <Sensor 1 Weight> ***CRC*** **EOT**

SOH <Sensor 2 Weight> ***CRC*** **EOT**

<DC4>

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

Examples

	Description
Read Gross Weight (Read Final) **COMMAND:** « 21110026₈ » **RESPONSE:** « 21110026₈ 81110026:00000064₈ »	**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:** « 21050026₈ » **RESPONSE:** « 21050026₈ 81050026: 100 kg G₈ »	**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 Final) **COMMAND:** «20050026₈ » **RESPONSE:** « 21050026₈ 81050026: 100 kg G₈ 82050026: 125 kg G₈ »	**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.

where

« is **<DC2>**

8 is message termination **CRLF or ';'**

» is **<DC4>**