



# ***TX 2 Analog Digitizer***

## **Technical Manual**

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# 1. SAFETY INSTRUCTIONS



**CAUTION** READ this manual BEFORE operating or servicing this equipment. FOLLOW these instructions carefully. SAVE this manual for future reference. DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment. ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance. CALL BAYKON ENGINEERING for parts, information, and service.



**WARNING** ONLY PERMIT QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.



**WARNING** FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD CONNECT TO PROPERLY GROUNDED OUTLET ONLY. DO NOT REMOVE THE GROUND PRONG.



**WARNING** DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING ANY CONNECTION, OPENING THE ENCLOSURE OR SERVICING.



**WARNING** BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT ALWAYS REMOVE POWER AND WAIT AT LEAST THIRTY (30) SECONDS BEFORE ANY CONNECTIONS OR DISCONNECTIONS ARE MADE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT OR BODILY HARM.



**CAUTION** OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.



## Declaration of Conformity

We;

BAYKON ENDÜSTRİYEL KONTROL SİSTEMLERİ SAN. VE TİC. A.Ş.

Kimya Sanayicileri Organize Sanayi Bölgesi Organik Cad. No:31  
34956 Tepeören Tuzla/İSTANBUL

to which this declaration relates, is in conformity with the following standard(s) or other normative document(s).

EC Directive:	Applicable Standards:
Low Voltage Directive (LVD): (2006/95/EC)	EN 60950-1
Electromagnetic Compatibility (EMC): (2004/108/EC)	EN 61326-1

Baykon, January 2010

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General Manager

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Quality Assurance Manager

## 2. INTRODUCTION

### 2.1. Overview

TX 2 family instruments are economic and powerful state-of-the-art technology digitizers for weighing and force measurements. TX 2 family instruments convert the low level strain gage load cell analog signal to digital signal in high resolution and accuracy to transmit digital data to PLC or PC. Their programmability for bipolar input signal is one of the instrument's advantages in bidirectional force measurement applications without decreasing the external unipolar resolution.

With a wide variety of interface, TX 2 instruments are used for any type of weighing processes and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

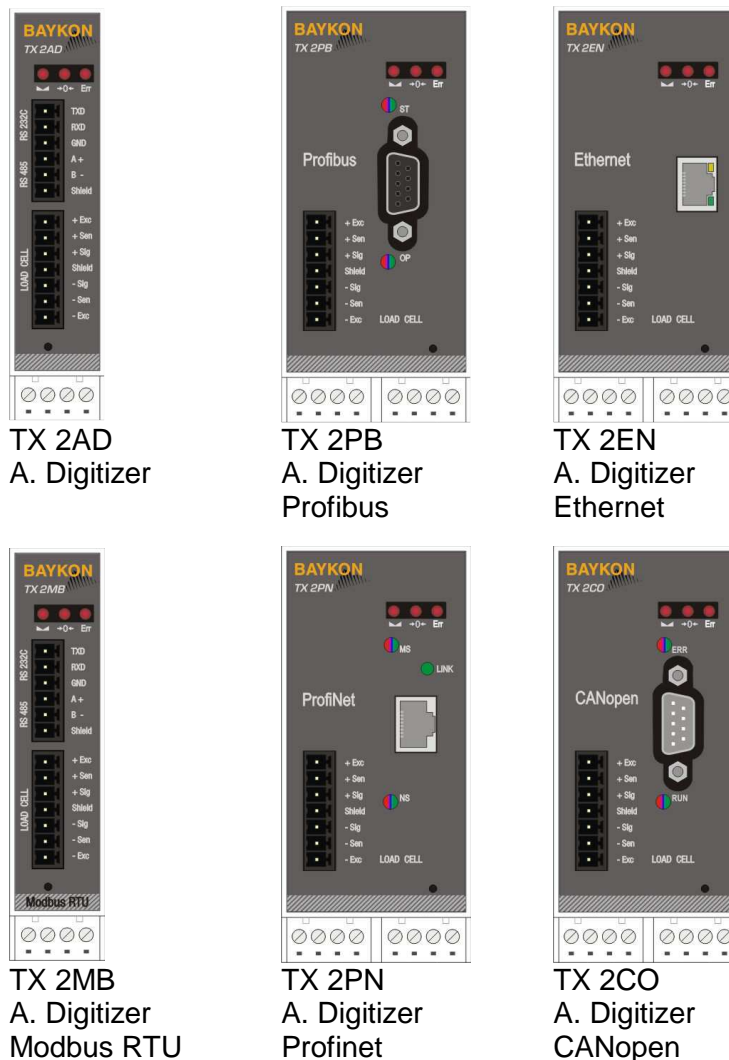


Figure 2.1 - TX 2 family instruments

## 2.2. Key features and specifications

### Features:

	TX 2AD	TX 2MB	TX 2PB	TX 2PN	TX 2EN	TX 2CO
Bipolar signal input at Force and Count modes	Yes	Yes	Yes	Yes	Yes	Yes
500 to 100 000 external resolution at calibrated data	Yes	Yes	Yes	Yes	Yes	Yes
Unipolar 1 000 0000 and bipolar 2 000 000 count is adjusted and filtered to external resolution in count mode	Yes	Yes	Yes	Yes	Yes	Yes
High internal resolution up to 8 000 000 counts	Yes	Yes	Yes	Yes	Yes	Yes
Up to 800 conversion per second	Yes	Yes	Yes	Yes	Yes	Yes
Serial interface RS-232C	Yes	Yes	Yes	Yes	Yes	Yes
RS-485 Interface	Yes	Yes	No	No	No	No
Profibus DPV1 interface	No	No	Yes	No	No	No
Profinet interface	No	No	No	Yes	No	No
Ethernet Interface	No	No	No	No	Yes	No
CANopen interface	No	No	No	No	No	Yes
Continuous data output	Yes	Yes	No	No	Yes	No
BSI data interface	Yes	Yes	No	No	Yes	No
Modbus RTU or TCP	No	Yes	No	No	Yes	No
Field bus address selection via programming switch ( from 0 to 7 )	Yes	Yes	Yes	No	No	Yes
Programming by BAYKON xFace PC software	Yes	Yes	Yes	Yes	Yes	Yes
Auto-zero tracking and auto-zero at power-up	Yes	Yes	Yes	Yes	Yes	Yes
Motion detection	Yes	Yes	Yes	Yes	Yes	Yes
Zeroing and Taring by field bus command	Yes	Yes	Yes	Yes	Yes	Yes
Adaptive digital filter for fast and stable reading	Yes	Yes	Yes	Yes	Yes	Yes
6 load cells 350 $\Omega$ or 18 load cells 1100 $\Omega$	Yes	Yes	Yes	Yes	Yes	Yes
Electronic calibration (eCal) without test weights	Yes	Yes	Yes	Yes	Yes	Yes
Zero and Span calibrations over field bus	Yes	Yes	Yes	Yes	Yes	Yes
Zero adjustment	Yes	Yes	Yes	Yes	Yes	Yes
Span adjustment with test weights	Yes	Yes	Yes	Yes	Yes	Yes
Span adjustment with temporary zeroing for unloaded tanks	Yes	Yes	Yes	Yes	Yes	Yes
Power-on testing with programming switch	Yes	Yes	Yes	Yes	Yes	Yes
10 to 28 VDC input voltage range	Yes	Yes	Yes	Yes	Yes	Yes



**Specifications:**

<b>Common Specifications</b>	
<b>A/D Converter:</b>	
A/D converter type:	24 bit Delta-Sigma radiometric with integral analog and digital filters
Conversion rate:	Up to 800 measurements per second
Input sensitivity:	0.1 $\mu$ V/e (non approved)
Analog input range:	0 mV to +18 mV ( unipolar ) ; - 18 mV to +18 mV ( bipolar )
Internal resolution:	up to 8 000 000
<b>External Resolution:</b>	
Count mode	1 000 000 count in unipolar signal range 2 000 000 count in bipolar signal range
Weighing and Force mode	up to 100 000 increment
<b>Scale Calibration and Functions:</b>	
Calibration:	Calibration is performed with or without etalon weights via xFace or field bus
Digital filter:	10 steps programmable adaptive filter
Weighing functions:	Taring, zeroing, auto zero tracking, motion detection, auto zero at power up, save tare at power-off, increased resolution
<b>Linearity:</b>	
	Within 0.0015% FS, $\leq$ 2 ppm/ $^{\circ}$ C
<b>Load cells:</b>	
Excitation:	5 VDC max. 100 mA
Number of load cells:	Up to 6 load cells 350 $\Omega$ or 18 load cells 1100 $\Omega$ in parallel
Connection:	4- or 6-wire technique. Cable length: maximum 250 m/mm <sup>2</sup> for 6-wire connection
<b>Communication:</b>	
RS-232C:	9600 baudrate, 8N1, used for service port (xFace)
<b>DC Power supply:</b>	
	10 to 28 VDC max. 300 mA
<b>Environment and Enclosure:</b>	
Operation temp.:	-10 $^{\circ}$ C to +40 $^{\circ}$ C; 85% RH max, non-condensing
Enclosure	Polyamide, mounting in standard DIN rails, IP20

<b>TX 2MB Modbus-RTU</b>	
<b>Communication:</b>	
RS-485:	1200 to 57600 baudrate, 8N1 / 7E1 / 7O1
Response delay:	Up to 4 ms. response delay after read/write commands
Max Stations:	Up to 31 stations per segment

<b>TX 2PB Profibus DP</b>	
<b>Communication:</b>	
Data rate:	Up to 12000 kbit/s with automatic baudrate detection
GSD file	Generic GSD-file provided
Topology:	Depending on physical media RS-485: segmented line topology without stubs
Installations:	Shielded twisted pair cable Line length depending on physical media and transmission speed
Max. Stations:	Up to 32 stations per segment, up to 126 stations per network
Isolation:	Galvanically isolated bus electronics
Response delay:	4 ms. response delay after read/write commands

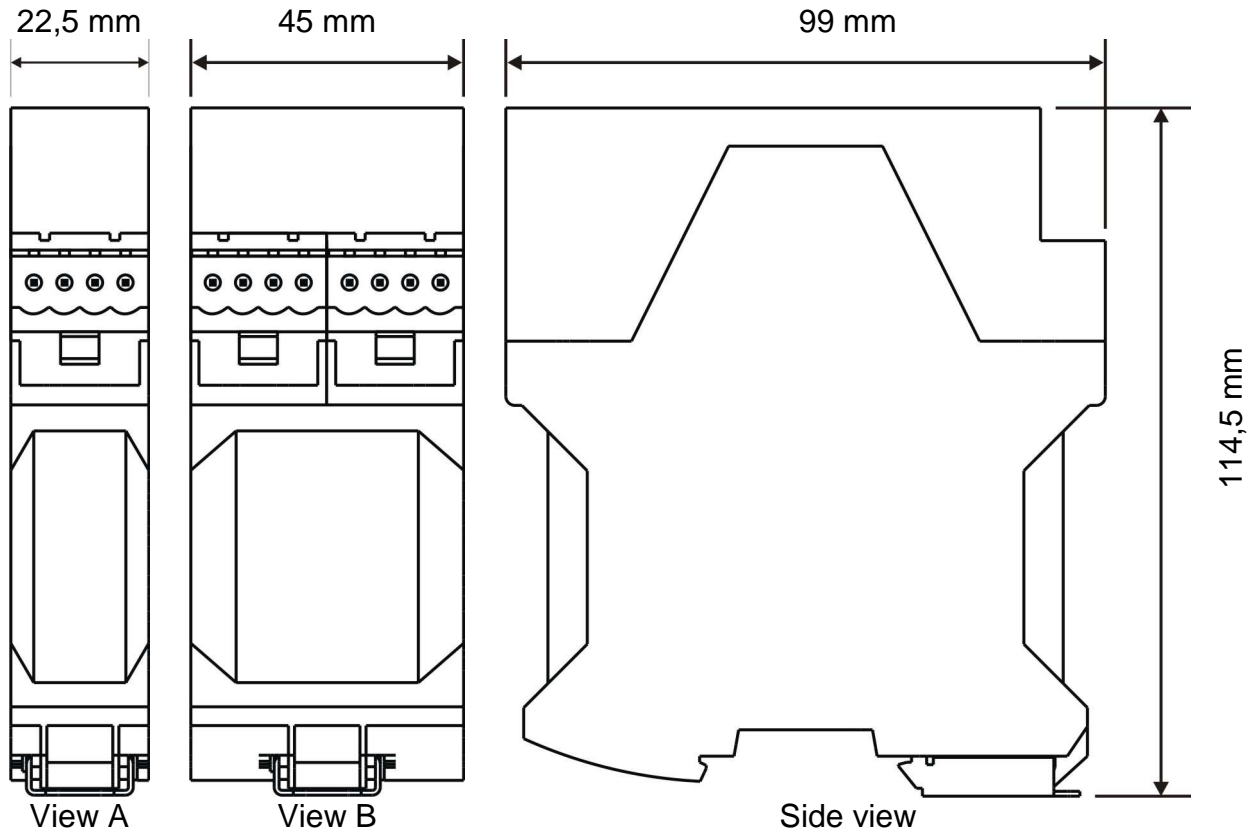
<b>TX 2PN Profinet</b>	
<b>Communication:</b>	
Data rate:	100 Mbit/s, full duplex
GSDML file:	Generic GSDML-file provided
TCP/IP settings:	DHCP or manual IP assign over xFace or Anybus Ipconfig, Device identity customization
Topology:	Line, Bus, Star or Tree topology depending on physical media
Installation:	Switched Ethernet transmission with shielded twisted pair cables and RJ-45 connectors.
Isolation:	Galvanically isolated bus electronics
Response delay:	4 ms. response delay after read/write commands

<b>TX 2EN Ethernet</b>	
<b>Communication:</b>	
Transmission rate:	10 Mbit/s, half duplex
Response delay:	4 ms. response delay after read/write commands
TCP/IP settings:	Manual IP assign over xFace
Installation:	Switched Ethernet transmission with shielded twisted pair cables and RJ-45 connectors.
Web client:	Available

<b>TX 2CO CANopen</b>	
<b>Communication:</b>	
Data rate:	10 kbit/s – 1 Mbit/s (selectable) kBit/s
ESD file	Generic ESD-file provided
Topology:	Line with Trunkline, Dropline structure and Termination at both Ends Line length depending on baudrate 25 – 500 meter.
Installation:	2 wire shielded twisted pair cable Alternatively 4 wire with 24 Volt power over the bus
Max. Stations:	Up to 127 stations per network
Isolation	Galvanically isolated bus electronics
Response delay:	4 ms. response delay after read/write commands

## 2.3. Housing

TX 2 housings are IP20, polyamide and easily mounting on NS 37/7 or NS 35/15 standard DIN rail. Drawings of the housings are seen below.



	TX 2AD	TX 2MB	TX 2EN	TX 2PB	TX 2PN	TX 2CO
View A	√	√				
View B			√	√	√	√

Figure 2.2 - Dimensions

## 2.4. Accessories

The following accessories are supplied with the instrument or can be purchased separately.

### 2.4.1. Accessories supplied with the instrument

The following accessories are supplied together with the TX 2 instruments. If any part is missed, please contact to your supplier.

	TX 2AD	TX 2MB	TX 2EN	TX 2PB	TX 2PN	TX 2CO
4-pos and 5 mm pitch light gray plug	1	1	2	2	2	2
7-pos and 3,81 mm pitch black plug for load cell cable	1	1	1	1	1	1
6-pos and 3,81 mm pitch black plug for RS-232C and RS-485	1	1				
Installation CD (xFace setup, user manual and technical documents)	1	1	1	1	1	1

Table 2.1 - Accessories supplied with instrument

### 2.4.2. Accessories sold separately

The following accessories can be supplied from BAYKON.

	TX 2AD	TX 2MB	TX 2EN	TX 2PB	TX 2PN	TX 2CO
RS-232C cable for PC connection (3 meter)	√	√	√	√	√	√
Junction box for load cell connection	Refer to junction box catalog					
Open end load cell cable 6 wire ( 0.22 cm <sup>2</sup> each )	Maximum 200 meter length					

Table 2.2 - Accessories supplied separately

## 3. INSTALLATION

**PRECAUTION:** Please read this manual carefully before installation of the instrument. Applying the recommendations in this section will increase your system reliability and long term performance.

### 3.1. Recommendations

#### 3.1.1. Control Cabinet Design

**Warning:** Please care the following warnings for designing the control cabinet which will increase your system reliability.

The control cabinet should be designed so that Analog Digitizer can operate safely. The panel should be placed clean area, not getting direct sun light if possible, with a temperature between -10 °C and +40 °C, humidity not exceeding 85% non-condensing. All external cables should be installed safely to avoid mechanical damages.

TX 2 instruments are very low level signal measuring instruments. To avoid electrical noise, TX 2 should be separated from the equipments that produce electrical noise. Preferable use metal cabinet against radio frequency interference and the cabinet shall be connected to ground against the electromagnetic disturbances. Load cell cable trays must be separated from others, if possible. If there are noise-generating equipments such as heavy load switches, motor control equipments, inductive loads etc., please be careful against the EMC interference in the cabinet. If possible protect TX 2 instruments with the faraday cage or install them in separate section or install them far a way from this kind of equipments. Connect parallel reverse diodes to the DC inductive loads like relays, solenoids etc. to minimize voltage peaks on the DC power lines.

#### 3.1.2. Cabling

All cables coming to the control cabinet shall be shielded. Please use separate cable trays for these low signal level cables. Distance from load cell cables, interface cables and DC power supply cables to power line cables shall be minimum 50 cm.

### 3.2. Mechanical Installation

After interior designing the control panel and installing DIN rails according to the recommendation in Section 3.1, place TX 2 instruments on the DIN

Be sure that the mechanical installation of the instruments is done properly.

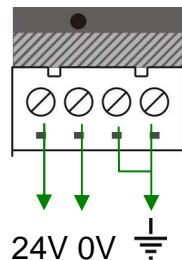
### 3.3. Electrical Connections

**Warning:** Please always remember that TX 2 instruments are very low voltage measuring instruments. Your control cabinet design and proper installation increases reliability and performance of the instrument. Please do not forget that the instrument must be powered off before inserting or removing any peripheral connector.

All required electrical connections should be done as described below.

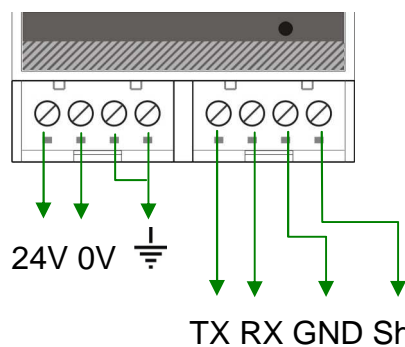
### 3.3.1. Power Supply and Grounding

Power supply voltage of the instrument shall be between 12 VDC and 28 VDC. The current resumption of the power supply will be calculated by multiplying 0,2A and the quantity of instruments. The pin configuration of the 24 VDC power supply connector located front bottom of the instrument is shown in Figure 3.1 below.



The pin layout of the 24 VDC connector of TX 2AD and TX 2MB

( front view )



The pin layout of the 24 VDC connector of TX 2EN, TX 2PB, TX 2PN, TX 2CO

( front view )

Figure 3.1 - The pin layout of 24VDC connector

The quality of the instrument's ground will determine the accuracy and the safety of your measuring system. A proper ground connection is needed to minimize extraneous electrical noise affects on the measurement. A poor ground can result in an unsafe and unstable operation. It is important that the instrument should not share power lines with noise-generating equipments such as heavy load switching, motor control equipments, inductive loads, etc. If the condition of the power line in the plant is poor, prepare a special power line and grounding.

Before interfering the instrument, turn off the power and wait at least for 30 seconds.

**Warning:** Do not forget to connect the Shield pin to the reference ground.

### 3.3.2. TX 2 Load Cell Connector

To avoid damages, the load cell wiring should be made carefully before energizing the instrument. Load cell connection detail is shown in Figure 3.2. In 4-wire installations the sense and excitation pins with the same polarity should be short circuited at the connector side. If you have junction box in your system, use 6 wire cable between TX 2 and the junction box, and short circuit these pins at junction box for better performance.

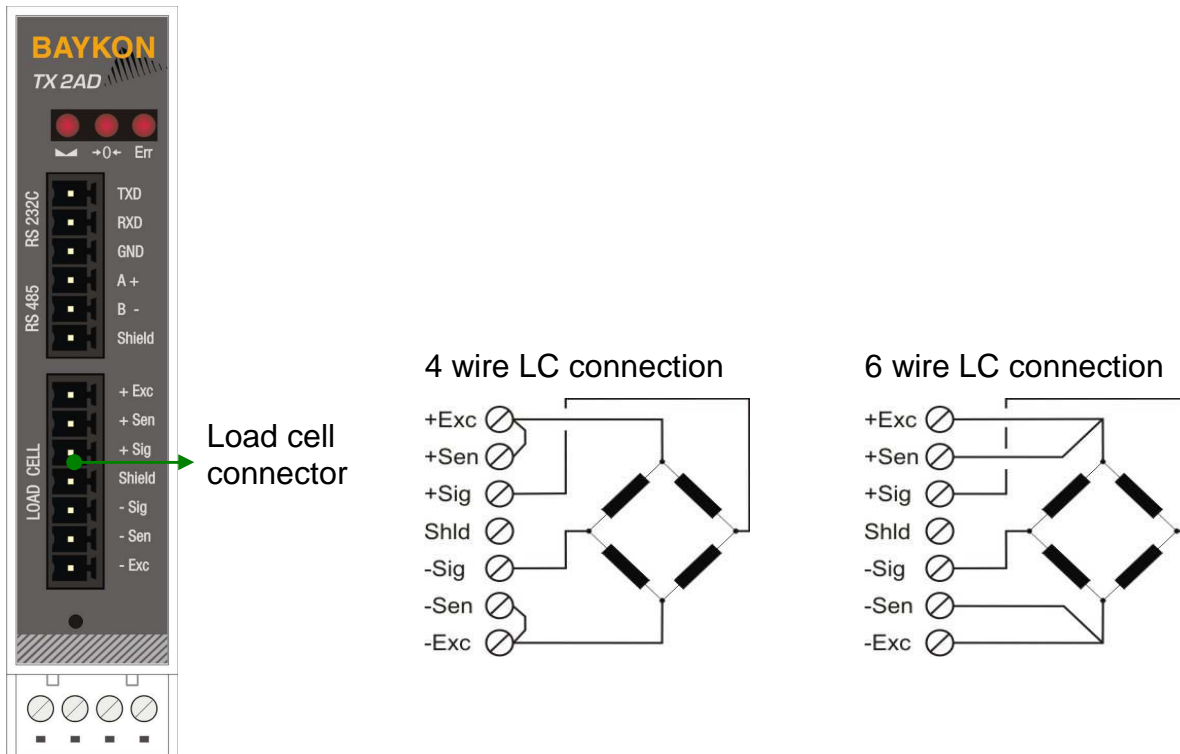


Figure 3.2 - Load cell connections

**Warning:** Connect the load cell cable shield to the reference ground or shield pin of the load cell connector.

### 3.3.3. Field bus Connector

You will find this connector details in the related gateway section.

Modbus-RTU Connection: Refer to Section 5.2

Profibus Connection: Refer to Section 6.2

Profinet Connection: Refer to Section 7.2

Ethernet Connection: Refer to section 8.2

CANopen Connection: Refer to section 9.2

### 3.3.4. RS-232C Serial Interface Connector

RS-232C serial ports are using for programming the instruments and for other purposes described in the related gateway section.

#### RS-232C Serial interface Specifications

Usage	Programming and calibration (xFace), Interfacing with PC or PLC,
Data formats	You will find the data format details in the related gateway section.
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1 stop bit

**Warning:** Connect the shield to the reference ground or shield pin of the power connector.

## 3.4. Commissioning

**PRECAUTION:** Please read this manual carefully before energizing the instrument. Perform the commissioning operation according the procedure given in this section. Only trained person is allowed for cleaning, commissioning, checking and servicing of the instrument. The interference of untrained person may cause some unwanted damages or injuries.

Before power on the instrument, please make the required mechanical and electrical installations. After power on, you have to program your TX 2 before field bus interfacing.

Install xFace to your PC as described at Section 4 Programming. xFace software is used for programming, calibration and testing of TX 2 instruments.

After checking the performance of instruments with xFace, you can begin to use TX 2 in your application.

## 4. PROGRAMMING

**PRECAUTION:** Please read this manual carefully before energizing the instrument. Perform the commissioning according the procedure is given in Section 3.4. Only trained person is allowed for commissioning, checking, cleaning and servicing of the instrument. The interference of untrained person may cause some unwanted damages or injures.

TX 2 family instruments are programmed and calibrated by xFace software supplied with the instrument. The latest version of xFace software can also be downloaded from BAYKON web site [www.baykon.com](http://www.baykon.com).

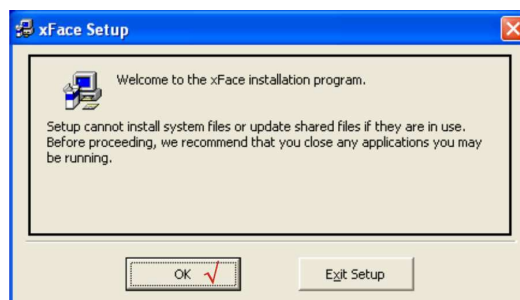
TX 2 instrument shall be programmed in sequence below before field bus interfacing;

- Install xFace software to your PC
- Connect PC and TX 2 over RS-232C Serial Interface
- Perform programming and calibration
- Perform Analog Digitizer performance tests

### 4.1. Installation of xFace

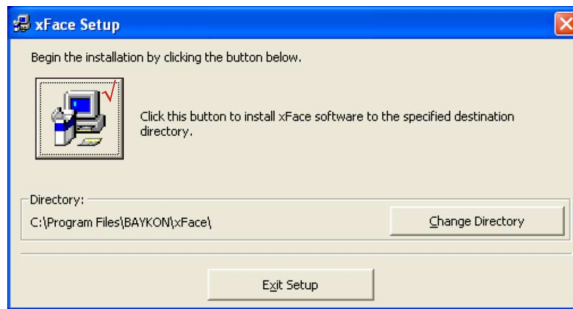
Please follow following steps to install the xFace software:

- Close all applications on your PC.
- Insert the CD that contains the xFace software into the CD-ROM drive.
- Double click to setup.exe to start installation. The setup Wizard is displayed.

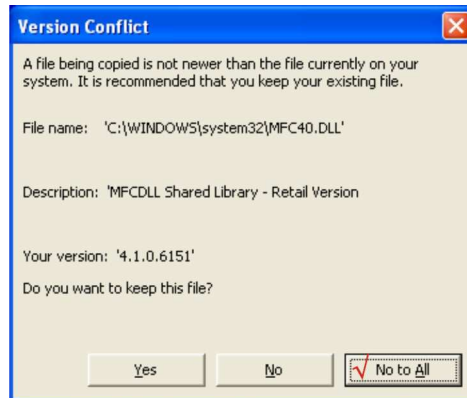


- Follow menus in the setup wizard step by step.
- The installation directory name shall be written with Latin characters. Chinese folder name is not supported.

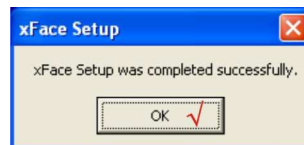




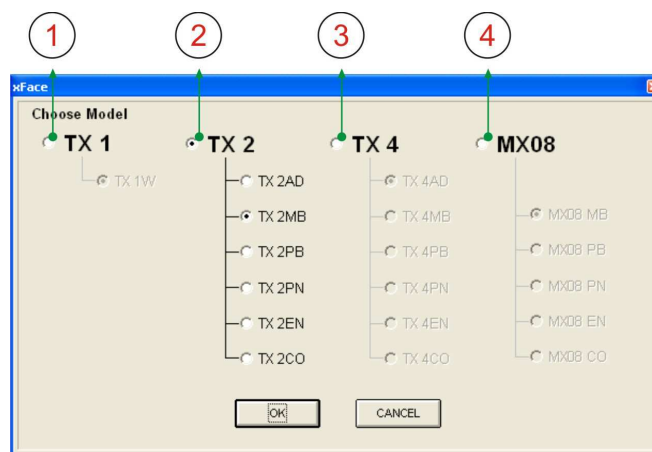
- If the Version Conflict window is displayed, click to “No to All” button.



- After finishing the installation, the Setup Wizard will inform you the software is installed successfully and then click to OK button.



- After closing the Setup Wizard you can start using the xFace software.



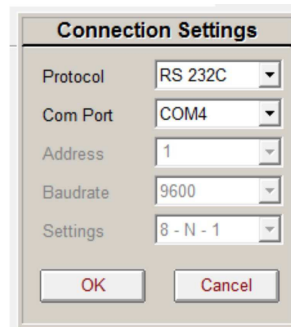
①	TX 1 Models
②	TX 2 Models: Select one of the TX 2 models and press OK button.
③	TX 4 Models
④	MX08 Models

Figure 4.1 - xFace model selector window

## 4.2. Connection to xFace

TX 2 and xFace connection is done via RS-232C service port for all instruments. Additionally, RS-485 for TX 2AD/MB can be used for xFace connection. You can supply any PC connection cable as an accessory from BAYKON (Refer to Section 2.4.2 Accessories sold separately).

After running xFace, select the instrument model you use. Select PC com port at connection settings menu in the tools tab and click the connect icon. The traffic lights of connect icon turns from red to green light when the communication is built between TX 2 instrument and your PC.



<b>Protocol:</b> Select programming port of the instrument. TX 2AD and TX 2MB instruments can be programmed over both RS-232C and RS-485. But the other type of instruments can be programmed over only RS-232C
---

<b>Com Port:</b> Select the com port of the PC.
---

<b>Address:</b> Select the address of the RS-485, if the protocol is selected RS-485.
---

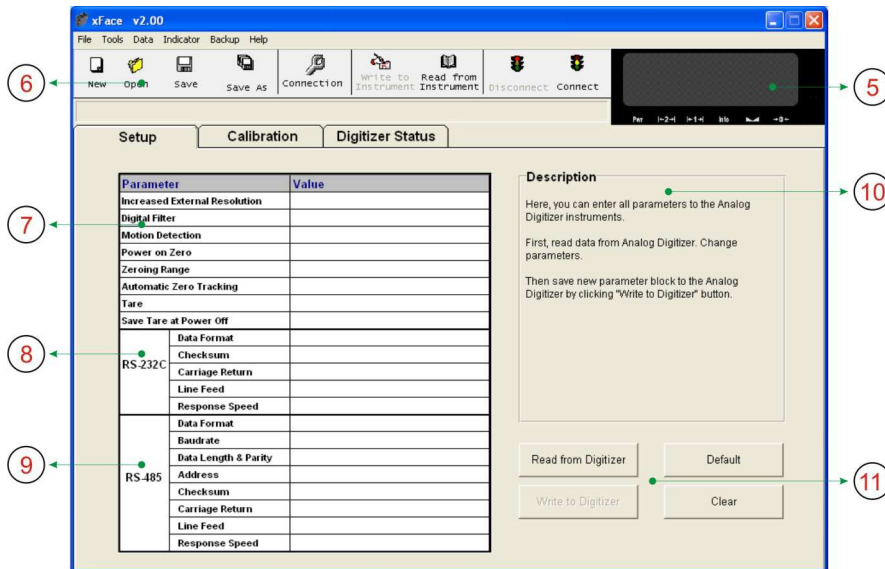
<b>Baudrate:</b> Select the baudrate of the RS-485, if the protocol is selected RS-485.
---

<b>Setting:</b> Select com port setting of the RS-485, if the protocol is selected RS-485.
--

Figure 4.2 - xFace Connection Settings

## 4.3. Analog Digitizer Programming and Calibration

**WARNING:** Read this manual carefully before programming and calibration of the instruments. This will increase your weighing system performance by applying proper programming and calibration.



5	<b>Visual Weight Display:</b> Displays the weight, count or force values.
6	<b>Toolbox:</b> Includes shortcuts of some special commands.
7	<b>Analog Digitizer Parameters:</b> This block allows the user to setup Analog Digitizer's parameters related to operation mode. Refer to 'Section 4.3.1'
8	<b>RS-232C:</b> RS-232C serial port communication settings.
9	<b>RS-485:</b> RS-485 port communication settings. (Only TX 2AD and TX 2MB)
10	<b>Description:</b> This block helps to user to explain the parameters.
11	<b>Read from Digitizer:</b> Click this button to read the parameters from the instrument.
	<b>Write to Digitizer:</b> Click this button to save the parameters to the instrument.
	<b>Default:</b> Click this button to load the default parameters to parameter fields.
	<b>Clear:</b> Empties the values of the parameters on the monitor.

Figure 4.3 - TX 2 setup parameters

For entering the parameter values enter set up tab, adjust parameter values and then write this data to the Analog Digitizer. After writing parameter values to the Analog Digitizer, calibrate the Digitizers.

### 4.3.1. Scale Parameters Setup

In setup menu, parameter values at TX 2 can be seen, changed and saved to TX 2. These parameters are;

#### Increased External Resolution

This parameter enables to follow the weight value as 10 time higher resolution than programmed division in weighing and force mode for service engineer.

Increased resolution must be disabled for usage in process.

(Not available in Count Mode)

*Default is 'Disable'.*

## Digital Filter

Environmental noises like bounding forces, air flow, vibration, motor control instruments etc disturb the load cell signal. The selection of proper filter determines how quickly the system will react to the load cell signal.

Load cell signal digital filtering is done according to the selected value of this parameter. This parameter values are changed from 0 (fastest settling by low filtering) to 9 (slowest settling by high filtering).

*Default is '7'.*

## Motion Detection

This parameter defines the motion detection window which determines the weighing is stable or dynamic. If the stable weight status is not required, this parameter can be disabled.

The available motion detection window values are (Weighing / Count);

Weighing and Force Mode:

± 0.3e	± 0.5e	± 1e	± 2e	No motion detection
--------	--------	------	------	---------------------

*Default is '± 0.5'.*

Count Mode:

± 60	± 100	± 200	± 400	No motion detection
------	-------	-------	-------	---------------------

*Default is '± 100'.*

## Power On Zero

This parameter enables automatic power on zeroing at the power on the instrument. This automatic zeroing is done if the total zero drift from the calibrated zero signal is in the selected range of the capacity.

The available power on zeroing windows in the percentage of the scale capacity are;

Disable	± 2%	± 10%
---------	------	-------

This parameter must be disabled or carefully programmed at the silo weighing, tank weighing or automatic weighing applications for preventing unwanted zeroing at power on.

If the weight is not in power on zeroing range, instrument is powered on without zeroing. (Not available in Count Mode)

*Default is 'Disable'.*

## Zeroing Range

Zeroing of the scale is performed if the difference between load cell signal value and unloaded load cell signal value at the calibration is in the selected percentage of the scale capacity. Zeroing can be done by zeroing command when the scale is stable.

The available zeroing ranges in the percentage of the scale capacity are;

Disable	$\pm 2\%$	$\pm 20\%$	$\pm 40\%$
---------	-----------	------------	------------

*Default is ' $\pm 2\%$ '.*

## Auto Zero Tracking

AZT automatically re-adjusts the scale to zero for compensating defined small deviations around the center of zero. AZT uses the range of zeroing and is not performed if this range is exceeded.

(Not available in Count Mode)

The available AZT window values are;

Disable	$\pm 0,5e$	$\pm 1e$	$\pm 3e$
---------	------------	----------	----------

This parameter must be disabled or programmed carefully at the silo weighing, tank weighing and automatic weighing applications for preventing unwanted zeroing.

*Default is 'Disable'.*

## Tare

If this function is enabled, the weight is tared when the tare command is received. Additional conditions for taring are positive gross weight and no motion. Multi-taring is possible at TX 2 family.

(Not available in Count Mode)

*Default is 'Enable'.*

## Save Tare at Power Off

If this function is enabled, tare value is stored at power off and instrument starts up in Net mode at power on.

(Not available in Count Mode)

*Default is 'Enable'.*

## RS-232C Data Format

This parameter programs the RS-232C communication port data format. The available data formats are;

- Disable : No data will be transmitted. Select disable if this port is not used.
- Continuous : The data is transmitted continuously. Refer to 'Section 4.9' for details.  
(Available for TX 2AD, TX 2MB and TX 2EN)
- BSI : Communicates in BSI data format as a slave. Refer to 'Section 4.10' for details.  
(Available for TX 2AD, TX 2MB and TX 2EN)
- Modbus RTU High-Low : Modbus RTU communication. Refer to *Section 5.6* for details.  
(Available for TX 2MB)
- Modbus RTU Low-High : Modbus RTU communication. Refer to *Section 5.6* for details.  
(Available for TX 2MB)

Note: xFace automatically connects to the instrument whatever the data format is. After xFace disconnection, the instrument returns to run with last saved data format.

Warning: Disable this interface if it is not used to increase the interfacing performance.

*Default is 'BSI'.*

## RS-232C Checksum

The checksum can be enabled or disabled from BSI and Continuous data format. The checksum calculation can be found in the related data format description.

*Default is 'Enable'.*

## RS-232C Carriage Return

Carriage Return can be enabled or disabled from Continuous data format.

*Default is 'Enable'.*

## RS-232C Line Feed

Line Feed can be enabled or disabled from Continuous data format.

*Default is 'Enable'.*

## Response Speed

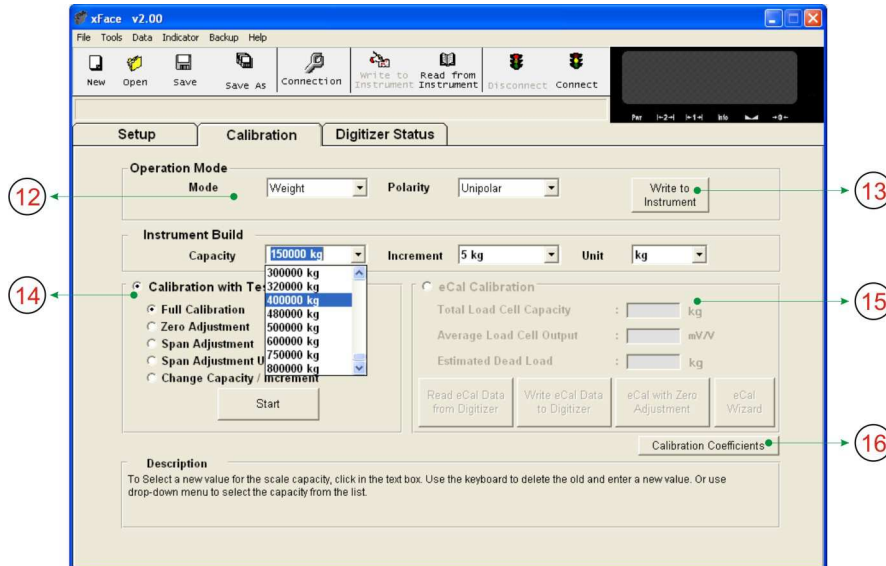
Response speed can be selected as "immediate" or "20 msec" for Modbus RTU data format.

- Immediate : Modbus RTU Answer is sent immediately after Request is received.
- 20 msec : Modbus RTU Answer is delayed 20 msec after Request is received.  
This property is very helpful for slow PLC systems.

*Default is 'immediate'.*

## 4.3.2. Calibration

Scale build, operation mode selection and scale calibration is performed in the calibration tab of xFace as seen in Figure 4.4. Please follow the procedure described in the following sections in sequence.



12	This block allows the user to select operation mode and polarity.
13	<b>Write to Digitizer:</b> Click this button to save the operation mode and polarity to Digitizer.
14	<b>Calibration block:</b> This block allows the user to make calibration with test weights.
15	<b>eCal Calibration:</b> This block allows the user to make calibration without test weights.
16	<b>Calibration Coefficients:</b> This function allows the user to restore calibration if they had been noted before.

Figure 4.4 – Calibration

### 4.3.2.1. Mode selection

TX 2 instruments have three operation modes which are;

- Count Mode : Filtered and normalized ADC count data is transmitted in this mode. The calibration is performed at PLC, if any.
- Weighing Mode : Unipolar weight data in calibrated weighing unit is transmitted. This mode is compatible to OIML R76 and EN 45501.
- Force Mode : Bipolar or unipolar force measurement data in calibrated force unit is transmitted.

Select scale operation mode and polarity. Click *Write to Digitizer* button to save your mode selection.

Default calibration of TX 2 instruments is Count Mode and 10 mV unipolar input signal range.

If you select the count mode, there is no scale build and instrument calibration. Each TX 2 instrument is adjusted in production to increase the calibration accuracy. TX 2 input signal ranges and their external resolutions are seen in Table 4.1.

Input signal range	Input Signal level	Polarity	External resolution
0 to 5 mV -5 to 5 mV	5 mV	Unipolar	1.000.000 count
		Bipolar	2.000.000 count
0 to 10 mV -10 to 10 mV	10 mV	Unipolar	1.000.000 count
		Bipolar	2.000.000 count
0 to 15 mV -15 to 15 mV	15 mV	Unipolar	1.000.000 count
		Bipolar	2.000.000 count
0 to 18 mV -18 to 18 mV	18 mV	Unipolar	1.000.000 count
		Bipolar	2.000.000 count

Table 4.1 - Count mode input signal ranges and external resolutions

Select the input signal level and polarity for high external resolution. Write your mode selection to the instrument by clicking *Write to Digitizer* button. Jump to the *Section 4.4*.

#### 4.3.2.2. Scale Build

The scale capacity, increment and unit must be introduced to the TX 2 instrument before performing calibration in Weighing and Force measurement.

Capacity : To select a new value for the scale capacity, click in the text box. Use the keyboard to enter a new value, or use drop-down menu.

Increment : Use the drop-down menu to select the increment.

Unit : Select the unit

Scale calibration can be performed by using test weights or by electronic calibration.

#### 4.3.2.3. Calibration with test weights

This calibration method performs zero and span calibrations using test weights. Test weight value should not be less than 1/10 of the scale capacity for accurate calibration.

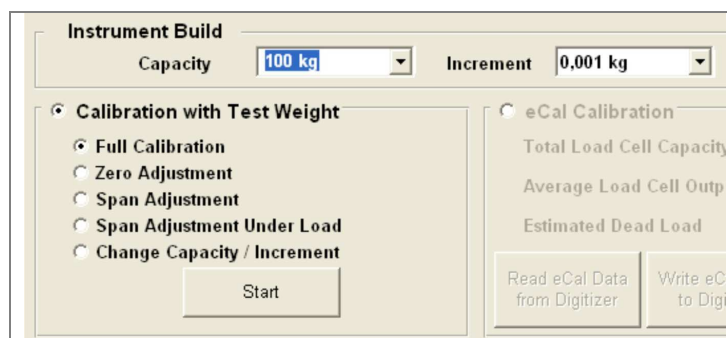


Figure 4.5 - Calibration with test weights



Please note that scale build values shall be entered before starting calibration.

Select *Full Calibration* for performing scale calibration. Click the *Start* button. Unload the scale for performing zero calibration and click *Yes* button. The virtual display will show [WAIT] message during zero calibration. During zero calibration the scale must be stable. Approximately 5 seconds later, the span calibration window is displayed. Load the scale and enter the loaded test weight value, then click *OK* button. The scale must be stable during span calibration. Approximately 5 seconds later, the new calibration settings are saved automatically.

If any error occurs during calibration, an error message warns you. Click *Yes* button to reload the previous values or click *No* button to use the new settings.

You can adjust zero or span of your scale without performing full calibration. Additionally, *span calibration to the unloaded scale* feature gives advantage to TX 2 instruments in after-sale service.

### **Zero Adjustment:**

If your scale has a residual zero drift, you may perform only zero adjustment. Select *Zero adjustment* and press *Start* button. Then, the zero calibration window is displayed. Unload the scale and click *OK* button. The [WAIT] message appears on the virtual display during zero adjustment. Approximately 5 seconds later zero adjustment will be finalized.

Note: Zero adjustment is also performed over field bus commands. Refer to data structure of related field bus.

### **Span Adjustment:**

If your scale has a span drift, you may perform only span adjustment. After selecting *Span adjustment* and pressing *Start* button, enter the test weight value; place the test weights on the scale and press *Yes* button. The [WAIT] message appears on the virtual display approximately for 5 seconds while span calibration is being performed. After finalizing the span adjustment, the instrument will save span coefficients automatically.

Note: Span adjustment is also performed over field bus commands. Refer to data structure of related field bus.

### **Span Adjustment under Load:**

This feature is being used to perform span adjustment without unloading the scale. This operation is especially used for span adjustment for non-empty tanks to make span adjustment without emptying the tank. After selecting *span adjustment under load*, press *Start* button. Temporary zeroing message appears on the monitor. This means the instrument will determine the existing load as temporary zero. If the scale is stable, press *Yes* button. The [WAIT] message appears on the virtual display approximately for 5 seconds to determine temporary zero. Then, the span calibration window is displayed. Load the scale and enter the loaded test weight value, then click *OK* button. The scale must be stable in this period. Approximately 5 seconds later, the new calibration settings are saved automatically.

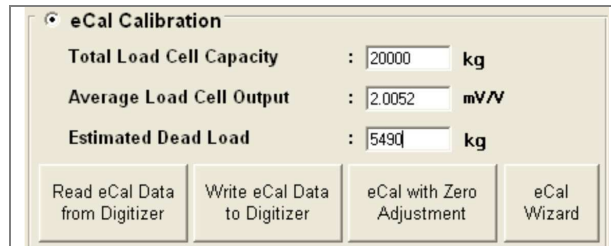
Please refer to the Section 4.4 Analog Digitizer Performance Testing.

### **Change Capacity / Increment:**

This feature is used to change Capacity/Increment without making re-calibration.

#### 4.3.2.4. eCal Electronic Calibration

eCal lets you to perform calibration without using test weights. TX 2 is adjusted in production for increasing eCal accuracy. Calibration is done by scale capacity, total load cell capacity, load cell output and estimated dead load values. If the conditions are convenient for zero calibration, you may perform automatic zero adjustment instead of entering estimated dead load.



eCal Calibration	
Total Load Cell Capacity	: 20000 kg
Average Load Cell Output	: 2.0052 mV/V
Estimated Dead Load	: 5490 kg
Read eCal Data from Digitizer	Write eCal Data to Digitizer
eCal with Zero Adjustment	eCal Wizard

Figure 4.6 - eCal Calibration

After selecting eCal calibration, enter the following values as;

**Total Load cell Capacity:** Enter total load cell capacity in kg as the example below.

Example: If the weighing system has 4 pcs 1000 kg load cell, enter 4000 kg.

**Average Load cell Output:** Enter load cell output sensitivity in mV/V. If the weighing system has more than one load cell, calculate the mean value of load cells outputs mV/V indicated on the certificates of the load cells.

Example: If load cell outputs are LC1: 2.0010, LC2: 1.9998, LC3:1.9986 and LC4:2.0002, the mean value will be

$$\text{LC output} = ( 2.0010 + 1.9998 + 1.9986 + 2.0002 ) \div 4 = 1.9999 \text{ mV/V.}$$

**Estimated Dead Load:** Enter the estimated dead load value of the weighing system in kg. You may perform zero adjustment in convenient time for exact dead load compensation.

After pressing *Save eCal Data to Digitizer*, these data transferred to the instrument and eCal is finalized.

If the scale is empty and you want to make automatic zero adjustment instead of entering estimated dead load, press *eCal with Zero Adjustment* button for starting zero calibration. The display will show [WAIT] message during zero adjustment for approximately 5 seconds. In this while the scale must be unloaded and stable. eCal calibration coefficients are saved automatically.

#### eCal Wizard:

eCal Wizard helps the user to calculate Total Load Cell capacity and Average Load cell Output values via entering each loadcell capacity and mV/V values.

## 4.4. Analog Digitizer Performance Testing

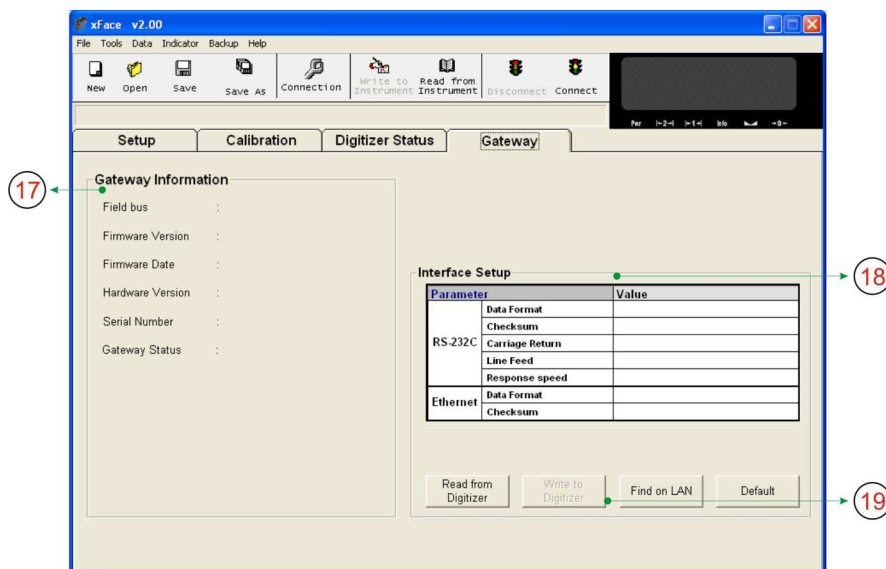
Scale performance testing shall be performed before field bus connection. These tests are linearity, repeatability and eccentricity.

You can follow the testing from virtual display and/or status tab which has measurement data, instrument data and software version. Taring, Zeroing and Clear keys are located in this tab for easy testing these functions.

## 4.5. Field bus Setup

TX 2 instruments have field bus and these parameters shall be programmed before field bus connection. Field bus settings are done in the Gateway tab.

Field bus parameters and their descriptions can be found in the related instrument section.



17	<b>Gateway information:</b> Allows the user to know about gateway controller.
18	<b>Field bus setup:</b> Network parameters of the instrument.
19	<b>Load Defaults:</b> Loads the default values.
	<b>Read from Digitizer:</b> Reads the parameters from the instrument.
	<b>Write to Digitizer:</b> Saves and activates the parameters to instrument.
	<b>Find on Network:</b> Search the instrument on network.

Figure 4.7 - Field bus Setup

## 4.6. GSD/GSDML/EDS Configuration

By default, Profibus, Profinet, CANopen data structures of TX 2 includes one Gateway and one Analog Digitizer. GSD/GSDML/EDS configuration for PLC programmers is shown in Figure 4.8.

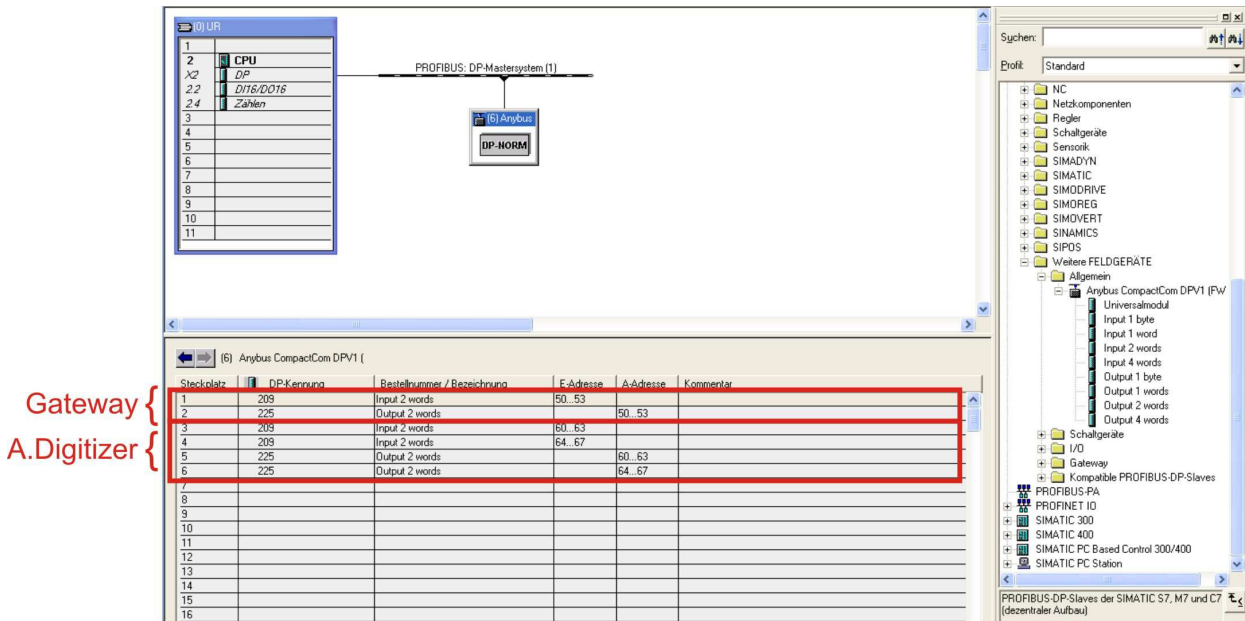


Figure 4.8 - GSD configuration

## 4.7. Field bus Addressing via Programming Switch

The field bus addressing of TX 2 instrument is done by xFace software (Refer to Section 4.3.1 Scale Parameters Setup). The alternative addressing way is using the programming switch on the front panel for addressing between 0 and 7 for RS-485, Profibus and CANopen interfacing. This feature gives you advantage for practical addressing the instrument up to 7 without PC connection.

For addressing via programming switch, press this switch for 5 seconds. Then status LEDs indicates the field bus address as seen the table below. If address is higher than 7, all LEDs flash. The address can be changed by pressing programming switch sequentially. To save and exit, press programming switch for 5 seconds. To return operation mode without saving, wait 15 seconds without pressing the switch.

☐	→0←	Err	Address Number
○	○	○	0 (No address)
○	○	●	1
○	●	○	2
○	●	●	3
●	○	○	4
●	○	●	5
●	●	○	6
●	●	●	7
✱	✱	✱	Over than 7

○ Blank   ● Light   ✱ Flash

Table 4.2 - Field bus Addressing

## 4.8. Back up Parameters and Calibration

The parameter settings and calibration coefficients can be saved to the back up file after reading these data from TX 2 instrument. This back up file can be written to TX 2 after opening it by xFace.

Back up feature gives service advantage to TX 2 instruments. Proposal is burning these files to CD / DVD and saving this back up CD / DVD in the control cabinet additional saving file in your PC.

**Important note:** The previous parameter values and calibration coefficients in TX 2 will be lost after loading back up to the instrument.

## 4.9. Continuous Data Structure

Continuous data output of the instrument is transmitted in the following data structure at the speed which is determined by the baud rate and the data length.

RS-232C serial port of TX 2 instruments are suitable for bi-directional communication. If you transmit ASCII codes of Z (zeroing), T (tare) or C (clear) letters to the serial port of TX 2, the indicator will act like the related keys are pressed.

CR and LF codes must be sent to end of ASCII command and only continuous data output can be programmed for more than one interface.

The data format and the definition of the continuous data format are given below.

In weighing and force modes:

Status				Indicated						Tare								
STX	STA	STB	STC	D5	D4	D3	D2	D1	D0	D5	D4	D3	D2	D1	D0	CR	LF	CHK

In count mode:

Status		Count Data								Not used								
STX	STB	D7	D6	D5	D4	D3	D2	D1	D0	D5	D4	D3	D2	D1	D0	CR	LF	CHK

The definition of the status bytes STA, STB and STC are given below.

Bits 0, 1 and 2							Bits 3 and 4			Bit 5	Bit 6	Bit 7
0	1	2	Decimal point	3	4	Increment size	Always 1	Always 1	X			
0	0	0	XXXXOO	1	0	X 1						
1	0	0	XXXXXO	0	1	X 2						
0	1	0	XXXXXX	1	1	X 5						
1	1	0	XXXXX.X									
0	0	1	XXXX.XX									
1	0	1	XXX.XXX									
0	1	1	XX.XXXX									
1	1	1	X.XXXXX									

Definition Table for Status B (STB)		
Bit 0	Gross = 0	Net = 1
Bit 1	Weight positive = 0	Weight negative = 1
Bit 2	No Error = 0	Error = 1
Bit 3	Stable = 0	Unstable = 1
Bit 4	Always = 1	
Bit 5	Always = 1	
Bit 6	Not power on zeroed	Zeroed with power on zero = 1
Bit 7	x	

Definition Table for Status C (STC)		
Bit 0	Always 0	
Bit 1	Always 0	
Bit 2	Always 0	
Bit 3	Always 0	
Bit 4	Always 1	
Bit 5	Always 1	
Bit 6	Always 0	
Bit 7	x	

CHK (Checksum) = 0 – (STX + STATUS A + ..... + LF)

Error Messages: UNDER, OVER, A.OUT, L-VOLT, H-VOLT,AD ERR are represented in Indicated or Count Data fields.

**Note:** The weight data is represented with right aligned and the error messages are represented with left aligned.

**Note:** The continuous data is started to send after 20 seconds after power-on.

## 4.10. BSI Data Structure

All new generation BAYKON instruments launched on the market support the standardized command set BSI data form, depending on the functionality of the instrument. This easy data format gives the reliable and speedy interface advantages with communicating PLC or PC for process control or transactional applications. You can expand your system with additional scales from BAYKON without having to change your application program base.

### General Rules:

1. Commands are only in CAPITAL.
2. CHK (2 ASCII char) can be enabled or disabled from both command and response.
3. Weight data is 8-byte with dot and non-significant zeros on the left.
4. Address (2 ASCII char) will be located in the structure for RS-485, if not 00.
5. Address bytes are default "10" for RS-232C and Ethernet interfaces.

Command format:

A general description of the command is the following:

[ADR][COMMAND][CHK][CR][LF]

Response format with weight / force or count data

A general description of the response is the following:

[ADR][COMMAND][STATUS][SIGN][WEIGHT/FORCE/COUNT][CHK][CR][LF]

Response format without weight / force or count data

[ADR][COMMAND][STATUS][CHK][CR][LF]

**Command Table:**

A	Read all weight data immediately
B	Read Gross weight value immediately
C	Clear the tare memory
D	Read Count value immediately
I	Read current weight (indicated) value immediately
G	Read voltage value of DC power supply
P	Print: Read the current stable weight value
S	Read Status
T	Tare
X	Read current weight value in increased resolution immediately
Z	Zero

**Status Table:**

A	Ack, the command is operated successfully
D	Dynamic, unstable weight
E	Errors except of H, L, O, +, -.
H	High voltage detected
I	The weight is in range
L	Low voltage detected
N	Nack, the command couldn't be operated
O	ADC out
S	Stable weight
X	Syntax error ( not recognized the received command )
+	Overload
-	Underload

Note: CHK, CR and LF will not be shown in below data format descriptions in this section.

**Commands and Responses:**

<b>A</b>	Read all weight data
----------	----------------------

Command : [ADR][A]  
 Response : [ADR][A][STATUS][SIGN][NET W][SIGN][TARE W][SIGN][GROSS W]  
 Example :  
           Command : 01A  
           Response : 01AS+000123.4+000111.1+000234.5  
                       01AD+000123.4+000111.1+000234.5  
                       01AO           ( ADC out error )

Comments :  
 The response is net, tare and gross weight values or error status.  
 All weight data is transmitted immediately after receiving the command.

<b>B</b>	Read Gross weight
----------	-------------------

Command : [ADR][B]  
Response : [ADR][B][STATUS][SIGN][WEIGHT VALUE]  
Example :  
Command : 01B  
Response : 01BS+000123.4 (gross weight is stable and 123.4)  
          : 01BD+000123.4 (gross weight is dynamic and 123.4)  
          : 01B- (under load)

Comments :  
The response is the gross weight value (stable or dynamic) or error status.  
Gross weight data is transmitted immediately after receiving command.

<b>C</b>	Clear the tare memory
----------	-----------------------

Command : [ADR][C]  
Response : [ADR][C][A] (Cleared and the scale is in gross mode)  
          : [ADR][C][X] (Clear command is unavailable in count mode)

Comments :  
The response status is always Ack in weighing or force mode and always X in count mode.

<b>D</b>	Read Count value immediately
----------	------------------------------

Command : [ADR][D]  
Response : [ADR][D][STATUS][SIGN][COUNT VALUE]  
Example :  
Command : 01D  
Response : 01DD+00123400  
          : 01DO (ADC out error)  
          : 01DX (Not in count mode)

Comments :  
Count value is send immediately.

<b>G</b>	Read voltage value of DC power supply
----------	---------------------------------------

Command : [ADR][G]  
Response : [ADR][G][STATUS][VOLTAGE VALUE]  
Example :  
Command : 01G  
Response : 01GA234 (Power supply is 23.4 VDC)  
          : 01GA150 (Power supply is 15.0 VDC)  
          : 01GA090 (Power supply is 9.0 VDC)

Comments :  
Voltage value is 3 byte and sends with 0.1 V increment.  
Available for TX 2AD and TX 2MB.



<b>I</b>	Read indicated weight
----------	-----------------------

Command : [ADR][I]  
Response : [ADR][I][STATUS][SIGN][WEIGHT VALUE]  
Example :  
Command : 01I  
Response : 01IS+000123.4 ( weight is stable and 123.4 )  
          : 01ID+000123.4 ( weight is dynamic and 123.4 )  
          : 01I+ ( overload )

Comments :  
The response is the indicated weight value (stable or dynamic). It will be transmitted immediately after receiving the command.  
The weight value may be in gross or net.

<b>P</b>	Print :Read the stable weight
----------	-------------------------------

Command : [ADR][P]  
Response : [ADR][P][STATUS][SIGN][WEIGHT VALUE]  
Example :  
Command : 01P  
Response : 01PS+000123.4 (weight is stable and 123.4) or  
          : 01PN (could not print)

Comments :  
Checks status and it must be stable. Else Nack status is send.  
There is no time duration for stability checking.  
Status can be Stable or Nack.

<b>S</b>	Read Status
----------	-------------

Command : [ADR][S]  
Response : [ADR][S][STATUS-1][STATUS-2][STATUS-3]  
Example :  
Command : 01S  
Response : 01SSGI (Stable, Gross, In Range)  
          : 01SDGL (Dynamic, Gross, Low voltage error)

Comments :  
The response includes 3 status information.

STATUS-1 can be Stable or Dynamic.  
STATUS-2 can be Gross or Net.  
STATUS-3 can be 'in range', 'out of range', 'low voltage' or 'high voltage'.

<b>T</b>	Tare
----------	------

Command : [ADR][T]  
Response : [ADR][T][A] (Taring is done successfully and scale is in net)  
          : [ADR][T][N] (Taring could not executed)  
          : [ADR][T][X] (Taring is disabled or instrument is in count mode)

Comments :  
The tare value is overwritten by the new tare weight value.  
Status must be stable in 2 seconds time out delay. If so, Ack is send.  
If it can not be stable in time out delay, Nack is send.

<b>X</b>	Read weight value in increased resolution
----------	---

Command : [ADR][X]  
 Response : [ADR][X][STATUS][SIGN][WEIGHT VALUE]  
 Example :  
           Command : 01X  
           Response : 01XS+00123.41 (weight is stable and 123.41) or  
                       01XD+00123.41 (weight is dynamic and 123.41) or  
                       01XE (Error)

Comments :  
 The response includes weight data with divided the increment to 10.  
 Available for TX 2AD and TX 2MB.

<b>Z</b>	Zero
----------	------

Command : [ADR][Z]  
 Response : [ADR][Z][A] (Zeroed)  
           [ADR][Z][N] (Zeroing could not be operated)  
           [ADR][Z][X] (Zeroing is disabled)

Comments :  
 Zero command can not work in net weighing.  
 Weight or Count must be in zeroing range for all operating modes.  
 Status must be stable in 2 seconds time out delay. If so, Ack is send.  
 If it can not be stable in time out delay, Nack is send.

CHK is transmitted as two ASCII characters calculated with the Checksum formulation.  
 Checksum = 0 – (SUM of all response data before CHK)

**Example:** Read stable current weight data.

BSI Examples: (CHK is enabled and instrument address is 01)

Command: 01P[CHK][CR][LF]

Checksum = 0 – (0x30 + 0x31 + 0x50) = 0 – 0XB1 = 0x4F  
 CHK = Char '4' and 'F'

Response: 01PS+000123.4[CHK][CR][LF]

Checksum = 0 – (0x30 + 0x31 + 0x50 + 0x53 + 0x2B + 0x30 + 0x30 + 0x30 + 0x31+ 0x32  
 + 0x33 + 0x2E + 0x34) = 0 – 0x02B7 = 0x49:  
 CHK = Char '4' and Char '9'

# 5. TX 2AD AND TX 2MB

TX 2AD and TX 2MB instruments are a state-of-the-art strain gage load cell signal digitizer with RS-485 and Modbus RTU interfaces in sequence. These instruments are used for any type of weighing processes and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

## 5.1. Front View

There are 3 annunciater LEDs on front panel to show the instrument status in operation.

The programming switch on front panel of the instrument is used for RS-485 addressing without PC (Refer to Section 4.7) and for diagnostic tests (refer to Section 5.8).

The operation mode of the instrument is announced by different lights at stable condition (refer to Table 5.1) and there is no zero indication in count mode operation.

When error LED lightened, other two LED announces the error type. Please refer to Section 5.7 for detailed error descriptions.

Load cell, power and serial interface terminals are located at the front of the DIN rail mount instrument as seen in

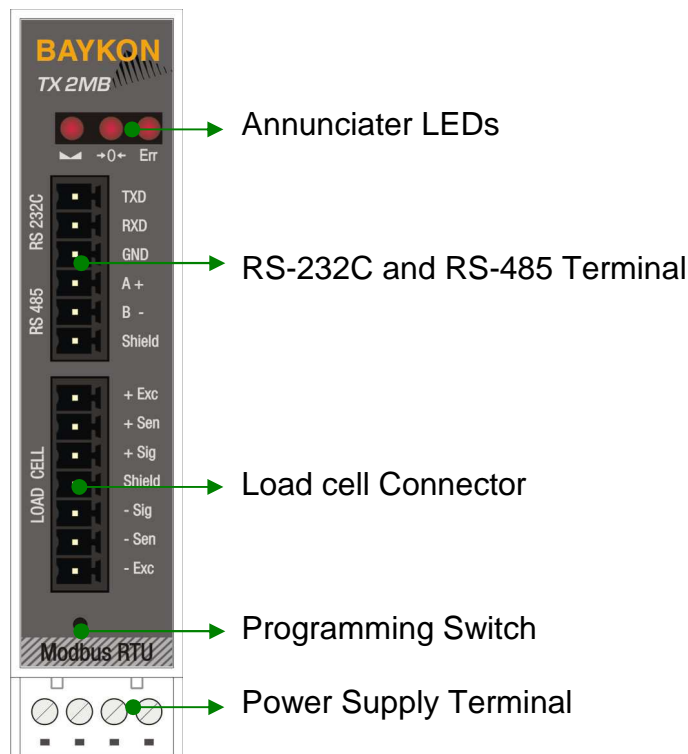


Figure 5.1 - Front view

The meanings of these LEDs in operation are given below.

LED		Operating Mode	
Symbol	Name	Weight / Force	Count
	Stable	<ul style="list-style-type: none"> <li>● Stable</li> <li>○ Unstable ( Dynamic )</li> </ul>	<ul style="list-style-type: none"> <li>⏻ Blanks for 0.3 seconds in 2 seconds period. ( No stable indication )</li> </ul>
	Centre of Zero	<ul style="list-style-type: none"> <li>● in the centre of zero range ( <math>-0.25 e &lt; w &lt; 0.25 e</math> )</li> <li>○ Out of centre of zero range</li> </ul>	<ul style="list-style-type: none"> <li>○ Always blank ( No centre of zero indication )</li> </ul>
Err	Error ( * )	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>⚡ Digital processing error</li> <li>○ No error</li> </ul>	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>⚡ Digital processing error</li> <li>○ No error</li> </ul>

○ Blank   ● Light   ⚡ Flash   ⏻ Blank for 0.3 second

( \* ) : Refer to the error table in Section 5.7

Table 5.1 - Annunciater LEDs

## 5.2. Electrical Connections

RS-485 and RS-232C and power supply terminals are shown in Figure 5.1.

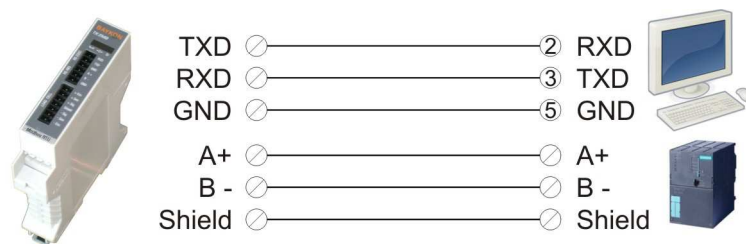


Figure 5.2 – TX 2AD and TX 2MB serial interface connections

### RS-232C Serial interface

Usage	Interfacing with PC or PLC, programming via xFace
Data formats	Continuous, BSI (Default), *Modbus RTU High-Low, *Modbus RTU Low-High
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1 stop bit

\* Available for TX 2MB

## RS-485 Serial interface

Usage	Interfacing with PC or PLC, programming via xFace
Data formats	Continuous, BSI (Default for TX 2AD), *Modbus RTU High-Low(Default for TX 2MB), *Modbus RTU Low-High
Baud rate	1200 / 2400 / 4800 / 9600 (Default) / 19200 / 38400 / 57600 bps
Length and parity	8 bit no parity (Default), 7 bit even, 7 bit odd
Start / Stop bits	1 start bit and 1 stop bit

\* Available for TX 2MB

**Warning:** Connect the shield to the reference ground.

**Warning:** Disconnect xFace PC software for Modbus-RTU interfacing.

### Load cell Connection:

To avoid damages, the load cell wiring should be made carefully before energizing the instrument. The input resistance of the connected load cells should fit the instrument specification you have. In 4-wire installations the sense and excitation pins with the same polarity should be short circuited at the connector side. If you have junction box in your system, use 6 wire cable between TX 2 and the junction box, and short circuit these pins at junction box for higher accuracy.

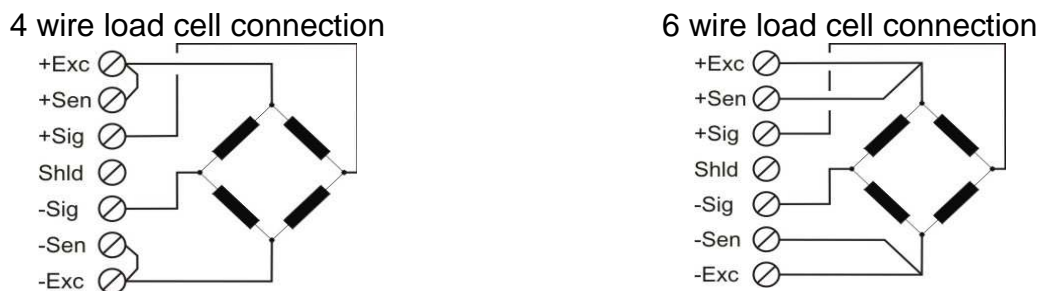


Figure 5.3 – Load cell connection

### Power Supply Connection:

The pin configuration of the 24 VDC power supply connector located on front bottom of the instrument is shown in Figure 5.4. Proper grounding is very important for the accuracy and the safety of your measuring system. Before interfering the instrument, please turn off the power and wait at least for 30 seconds.

**Warning:** Connect the shield terminal to the reference ground.

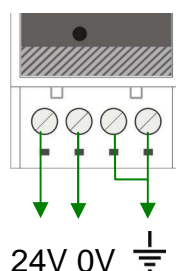


Figure 5.4 - Pin layout of 24VDC Connector

## 5.3. Interfacing

TX 2AD and TX 2MB instruments have two serial interface connectors on the front of the instruments: RS-485 and RS-232C serial interface connector.

TX 2AD and TX 2MB instruments interface with its peripheral in to programmed data structure. The table below describes the data formats for interfacing the peripherals and their application:

Data Format	Description	Application	Hardware
Continuous	Asynchronous continuous data format. Refer to 'Section 4.9'.	Continuous data transfer to PC or PLC Remote display connection Remote Taring, Zeroing	RS-232C RS-485
BSI	Demand interface on BSI Serial Interface format. Refer to 'Section 4.10'	Master – Slave data interfacing with PLC or PC.	RS-232C RS-485
Modbus RTU High-Low (only TX 2MB)	Modbus RTU interfacing. Refer to 'Section 5.6'.	Interfacing with PLC.	RS-232C RS-485
Modbus RTU Low-High (only TX 2MB)	Modbus RTU interfacing. Refer to 'Section 5.6'.	Interfacing with PLC.	RS-232C RS-485

Table 5.2 - Serial data output interfacing

**Attention:** Please disable the interface you will not use to increase the performance of the instrument.

## 5.4. Programming and Calibration

TX 2 instruments are programmed and calibrated by xFace. Analog digitizer parameter values are very important for better weighing performance. Please refer to Section 4.3.

## 5.5. RS-485 Setup

RS-485 set up is done by xFace software as described in this section.

Select Setup tab after connecting xFace to instrument. Setup tab is seen in Figure 4.3. You will see the RS-485 parameters in this tab.

### 5.5.1. RS-485 Parameters

#### Data Format

This parameter programs the RS-485 port data format. The available data formats are;

- Disable : No data will be transmitted. Select disable if this port is not used.
- Continuous : The data is transmitted continuously. Refer to Section 4.9 for details.
- BSI : Communicates in BSI data format as a slave. Refer to Section 4.9 for details.

Modbus RTU High-Low : Modbus RTU communication. Refer to *Section 5.6* for details. (only TX 2MB)

Modbus RTU Low-High : Modbus RTU communication. Refer to *Section 5.6* for details. (only TX 2MB)

Default is *BSI* in TX 2AD and *Modbus RTU High-Low* in TX 2MB.

### **Baudrate**

One of the following baudrate is selected for RS-485 communication port.

1200	2400	4800	9600
19200	38400	57600	

*Default is '9600'*

### **Data Length and Parity**

The data length and parity can be selected as 8 None 1, 7 Odd 1 or 7 Even 1.

*Default is '8 None 1'.*

### **Address**

The address range is 1 to 31. If you enter 0, the instrument will operate without address data.

*Default is '01'.*

### **Checksum**

The checksum can be enabled or disabled from BSI and Continuous data format. The checksum calculation can be found in the related data format description.

*Default is 'Enable'.*

### **Carriage Return**

Carriage Return can be enabled or disabled from Continuous data format.

*Default is 'Enable'.*

### **Line Feed**

Line Feed can be enabled or disabled from Continuous data format.

*Default is 'Enable'.*

### **Response Speed**

Response speed can be selected as "immediate" or "20 msec" for Modbus RTU data format.

Immediate (Default) : Modbus RTU Answer is sent immediately after Request is received.

20 msec : Modbus RTU Answer is delayed 20 msec after Request is received.  
This property is very helpful for slow PLC systems.

## 5.6. Modbus RTU Data Structure (only TX 2MB and TX 2EN)

If the instrument is programmed for Modbus, it can be used as a Modbus RTU slave on RS-485 communication network. The Modbus slave address is defined in the RS-485 address in 'Section 5.2'. Functions code '0x03' and '0x10' are supported.

### Installation:

Set the RS-485 Data Format: 'Modbus RTU High-Low' or 'Modbus RTU Low-High',  
RS-485 Data Length & Parity: '8 none 1',  
RS-485 Address: '01' to '31'

Make the RS-485 parameter settings as defined in 'Section 5.5.1'

### Modbus RTU Command Table;

Address	R/W	Word	Command	Definition			
40001	R	2	Weight / Force / Count Data				
40003	R	1	Status	D0	0 – System Ready	1 – System Busy	
				D1	0 – Error	1 – Data ok	
				D2	0 – Weight Stable	1 – Weight unstable	
				D3	0 – Gross Mode	1 – Net mode	
				D4	0	Not Used	
				D5	0 – Weight / Force	1 – Count Mode	
				D6	0	Not used	
				D7	0		
				D8	0		
				D9	0		
				D10	0		
				D11	0		
				D12	0 – Out of zero range	1 – Weight is in zero range	
				D13	Error Code	0	No Errors
				D14		1	ADC out of range
D15	2	ADC over range					
	3	ADC under range					
	4	System error					
		5	In programming mode				
		6	Low/High voltage det.				
40004	R	2	Tare weight				
40006	R	2	Gross weight				
40008	R	1	Status	Motion, Net mode, Data ok, (image of register 40003)			
40009	R/W	1	Control	0	None		
				1	Zero		
				2	Tare		
				3	Clear		
40010	R/W	1	Calibration	0	None		
				188	Adjust Zero Calibration		
				220	Adjust Span Calibration (First load 40011 with span test weight value)		
40011	R/W	2	Span Calibration Value				



40013	R	1	Calibration Status	D0 .. D7	1	Ready for calibration	
					3	Zero calibration in process	
					4	Span calibration in process	
					9	Error (Refer to D8 ... D15 )	
				D8 .. D15	Calibration Errors	1	Calibration Timeout - Restart calibration
						2	ADC Error - Re-energize the instrument - If seen again, change the board.
						3	Instrument can not be calibrating - Check load cell cable - Re-energize the instrument
34	35	37	Instrument can not be calibrating - Load cell signal is very low or too high				
			Calibration Error - Calibration test weight is not enough - Increase calibration weight value (40011) - Check load cell connections				
		Scale unstable - Wait until scale become stable - Check grounding wiring					
40014	R/W	1	Operation Mode Select	0	Count Mode Unipolar		
				1	Count Mode Bipolar		
				2	Force Mode Unipolar		
				3	Force Mode Bipolar		
				4	Weight Mode Unipolar		
40015	R/W	1	Operation mV of Count Mode	0	5 mV		
				1	10 mV		
				2	15 mV		
				3	18 mV		
40016	R/W	1	Digital Filters	0	Fast		
				1			
				2			
				3			
				4			
				5	Medium		
				6			
				7	Default		
				8			
				9	Slow		
40034	R	1	Voltage of Power Supply	Voltage of power supply is indicated with 0.1 V increment. For example: 23.4 VDC is indicated as integer 234 value.			

## EXPLANATION:

Attention: For hardware connection details, please refer to the related hardware descriptions in this manual.

**Modbus RTU High-Low:** In two word registers, the data is stored to the registers in big-endian format. Least significant word is stored to the highest register address; and most significant word is stored to the lowest register address.

**Modbus RTU Low-High:** In two word registers, the data is stored to the registers in little-endian format. Least significant word is stored to the lowest register address; and most significant word is stored to the highest register address.

Please find Modbus information in the web site of <http://www.modbus.org>

Exception codes:

- 1: Function code is not supported.
- 2: Out of beginning and ending address range.
- 3: Invalid value entrance or wrong byte number.
- 4: Operation error.

## Examples:

Performing Read and Write operations according (Modbus RTU High-Low) to hex system with the instrument set to address "0x01".

Request weight data	: 01,03,00,00,00,02,C4,0B
Answer of request weight	: 01,03,04,00,01,86,A0,38,4A
Weight is 100000	
Request status data	: 01,03,00,02,00,01,25,CA
Taring	: 01,10,00,08,00,01,02,00,02,26,D9
Request tare data	: 01,03,00,03,00,02,34,0B
Answer of request tare	: 01,03,04,00,00,27,10,E0,0F
Tare is 10000	
Weight Mode Selection	: 01,10,00,0D,00,01,02,00,04,A6,8E
Count in Unipolar Mode Selection	: 01,10,00,0D,00,01,02,00,00,A7,4D
5 mV Input signal range selection	: 01,10,00,0E,00,01,02,00,00,A7,7E
Load Medium (5) to Digital filter	: 01,10,00,0F,00,01,02,00,05,66,AC
Request Calibration Status	: 01,03,00,0C,00,01,44,09
Answer of request Calibration Status	: 01,03,02,00,01,79,84
Instrument is ready for calibration	
Zero Calibration Command	: 01,10,00,08,00,01,02,00,01,66,D8
Span Calibration with Span Value 50000	:01,10,00,09,00,03,06,00,DC,00,00,C3,50,B7,B0

## 5.7. Error Table

The TX 2 load cell signal digitizers have been designed as very reliable and virtually error free instruments. However if an error occurs do not attempt to repair the equipment before you understand what caused the error. Note the problems you have with your instrument and the error messages shown by the LEDs located on the front panel. Then try to solve the problem according to the error table given below.


Error Code			Description	Actions to take / Possible cause
		<b>Err</b>		
			ADC Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Over Load	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			Weight is too low	
			ADC Out	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Check the calibration.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			System Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			High Voltage Detected	– Check the power supply that the voltage is in the required voltage range.
			Low Voltage Detected	– Check the power supply that the voltage is in the required voltage range.


























Blank   Light   Flash

Table 5.3 - Error table

## 5.8. Diagnostic Tests


RS-232C and RS-485 serial interface tests; and load cell signal analog digital conversion&processing tests are performed sequentially in this test menu.

For entering diagnostic test mode, press the programming switch before power on and release the switch after power on the instrument. The instrument will go in to the RS-232C RXD test mode which is indicated by lighted  LED and flashed Err LED as seen below. The status of LEDs on the front panel indicates test steps and the test result as described below. You can go to the next test by pressing the programming switch.

Test	LED's Status			Description
			Err	
RS-232C RxD				 LED blanks 0.3 sec after receiving any data. Press programming switch to go next test.
RS-232C TxD				'A' to 'Z' characters are send sequentially in 0.8 s period. If the same data is received,  LED blanks 0.3 sec. Press programming switch to go following test.
RS-485 RD				 LED blanks 0.3 sec after receiving any data. Press programming switch to go following test.
RS-485 TD				'A' to 'Z' characters are send sequentially in 0.8 sec period. Press programming switch to go following test.
Load cell signal				 LED blanks while load cell signal increases. Press programming switch to go following test.
				 LED blanks while load cell signal decreases. Press programming switch to go back RS-232C RxD test.

 Blank    Light    Flash    Blank for 0.3 second

Table 5.4 - Diagnostic Tests

If you short circuit RXD and TXD pin of the instrument's RS-232C port and go in to TxD test, the receiving data, announced by  LED, indicates the instrument's interface pins have functionality.

Press programming switch for 5 seconds to exit diagnostic test mode and go to operation mode.

## 6. TX 2PB PROFIBUS

TX 2PB instruments are a state-of-the-art strain gage load cell signal digitizer with Profibus interface. This instrument is used for any type of weighing processes and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

GSD file is available in CD which is supplied together with the instrument.

### 6.1. Front View

There are 3 annunciater LEDs on front panel to show the instrument status in operation and 2 LEDs (ST, OP) for showing Profibus status in operation.

The programming switch on front panel of the instrument is used for Profibus addressing without PC (Refer to Section 4.7) and for diagnostic tests (Refer to section 6.8).

The operation mode of the instrument is announced by different lights at stable condition (refer to Table 6.1) and there is no zero indication in count mode operation.

When error LED lightened, other two LED announces the error type. Please refer to Section 6.7 for detailed error descriptions.

Load cell, Profibus, power and serial interface terminals are located at the front of the DIN rail mount instrument as seen in below.

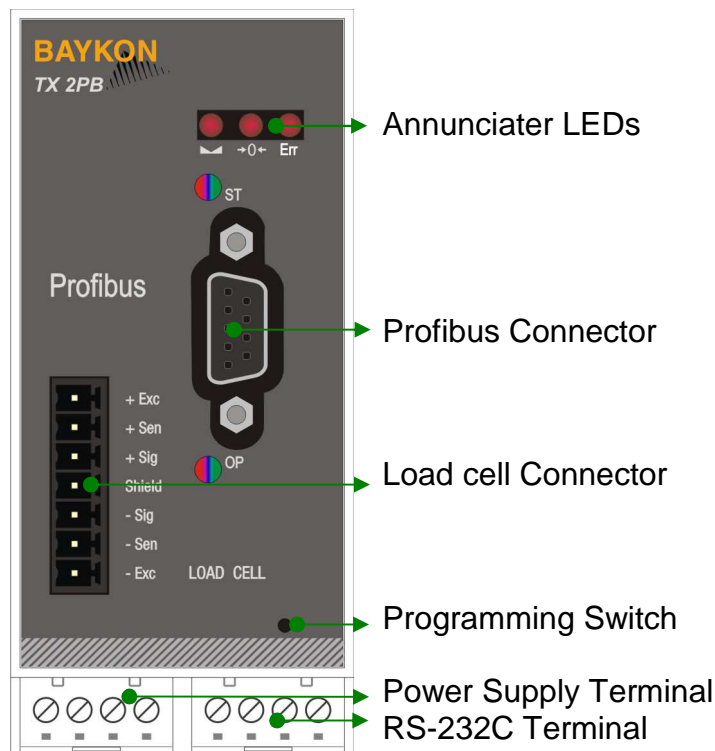


Figure 6.1 - Front view

The meanings of these LEDs in operation are given below.

LED		Operating Mode	
Symbol	Name	Weight / Force	Count
	Stable	<ul style="list-style-type: none"> <li>● Stable</li> <li>○ Unstable ( Dynamic )</li> </ul>	<ul style="list-style-type: none"> <li>⏻ Blanks for 0.3 seconds in 2 seconds period. ( No stable indication )</li> </ul>
	Centre of Zero	<ul style="list-style-type: none"> <li>● in the centre of zero range ( <math>-0.25 e &lt; w &lt; 0.25 e</math> )</li> <li>○ Out of centre of zero range</li> </ul>	<ul style="list-style-type: none"> <li>○ Always blank ( No centre of zero indication )</li> </ul>
Err	Error ( * )	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>✱ Digital processing error</li> <li>○ No error</li> </ul>	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>✱ Digital processing error</li> <li>○ No error</li> </ul>

○ Blank   ● Light   ✱ Flash   ⏻ Blank for 0.3 second

( \* ) : Refer to the error table in Section 6.7.

Table 6.1 - Annunciater LEDs

### ST Status LED

State	Indication	Comment
Off	Not power or not initialized	No power or profibus module is in initialization state
Green	Initialized	
Flashing Green	Initialized, diagnostic event(s) present	Diagnostic is active
Red	Exception error	There is an exception error

### OP Operation mode LED

State	Indication	Comment
Off	Not online /No power	Check power and cable
Green	On-line, data exchange	-
Flashing Green	On-line, clear	-
Flashing Red (2 flash)	PROFIBUS configuration error	Check GSD file configuration.

## 6.2. Electrical Connections

Profibus, RS-232C and power supply terminals are shown in Figure 6.1.

### PROFIBUS Connector (DB9F)

Pin	Signal	Description
1	-	-
2	-	-
3	B Line	Positive RxD / TxD, RS-485 level
4	RTS	Request to send
5	GND Bus	Ground (isolated)
6	+5V Bus Output	+5V termination power (isolated)
7	-	-
8	A Line	Negative RxD / TxD, RS-485 level
9	-	-
Housing	Cable Shield	Ground

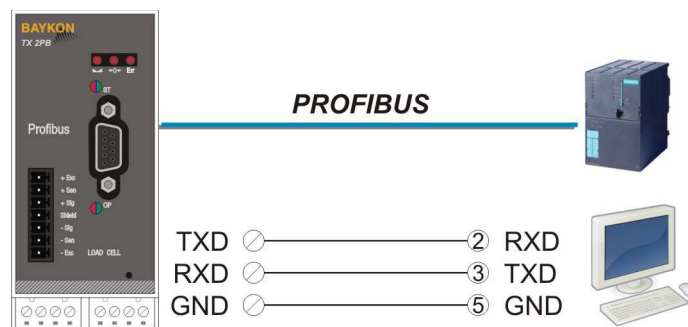


Figure 6.2 - TX 2PB serial interface connections

### RS-232C Serial interface

Usage	Used for service port (xFace)
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1 stop bit

### Profibus-DP interface

Usage	Interfacing with PC or PLC
Data formats	Profibus
Baud rate	Automatically detected and supported baud rates are 9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5Mbps, 3 Mbps, 6 Mbps and 12 Mbps. No 'baud rate' instance exists.

**Warning:** Connect the shield to the reference ground or shield pin of the power connector.

**Warning:** Disconnect xFace PC software for Profibus interfacing.

### Load cell Connection:

To avoid damages, the load cell wiring should be made carefully before energizing the instrument. The input resistance of the connected load cells should fit the instrument specification you have. In 4-wire installations the sense and excitation pins with the same polarity should be short circuited at the connector side. If you have junction box in your system, use 6 wire cable between TX 2PB and the junction box, and short circuit these pins at junction box for higher accuracy.

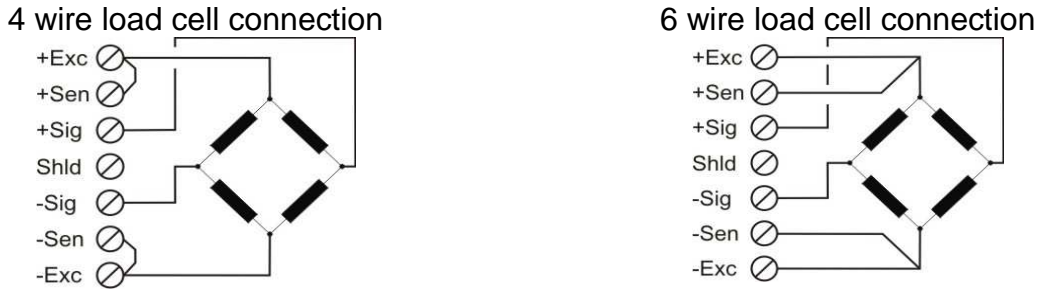


Figure 6.3 - Load cell connection

### Power Supply Connection:

The pin configuration of the 24 VDC power supply connector located on front bottom of the instrument is shown in Figure 6.4. Proper grounding is very important for the accuracy and the safety of your measuring system. Before interfering the instrument, please turn off the power and wait at least for 30 seconds.

**Warning:** Connect the shield terminal to the reference ground.

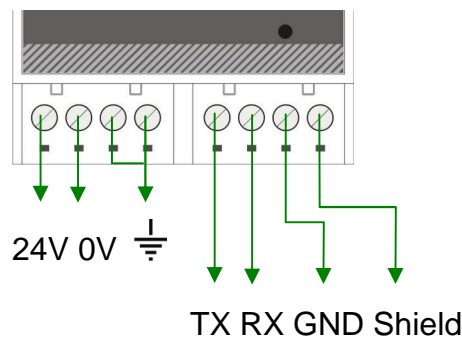


Figure 6.4 - Pin layout of TX 2PB 24VDC connector



## 6.3. Interfacing

TX 2PB instruments have two serial interface connectors on the front of the instruments: Profibus and RS-232C serial interface connector.

TX 2PB instrument interfaces with its peripheral in to programmed data structure. The table below describes the data formats for interfacing the peripherals and their application:

Data Format	Description	Application	Hardware
Profibus	Profibus interfacing. Refer to 'Section 6.6'.	Interfacing with PLC.	Profibus-DPV1

Table 6.2 - Serial data output interfacing

**Attention:** Please disable the interface you will not use to increase the performance of the instrument.

## 6.4. Programming and Calibration

TX 2 instruments are programmed and calibrated by xFace. Analog digitizer parameter values are very important for better weighing performance. Please refer to Section 4.3.

## 6.5. Profibus Setup

Profibus set up is done by xFace software as described in this section.

Select Gateway tab after connecting xFace to instrument. You will see the Profibus parameters in this tab.

### 6.5.1. Profibus Parameters

There is only one parameter for Profibus network.

#### Profibus Rack Address

The address range is 1 to 126.

*Default is '01'.*

,

## 6.6. Profibus DP Data Structure

### TX 2PB Output to PLC Input

#### Bitwise of Dword:

Dword (R/W)	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

1st Dword	Not in use									
2nd Dword	By default, Indicated Weight value is represented. To represent other weight or calibration status, refer to next Dword.									
3rd Dword	Not in use									
	<table border="1"> <tr> <td>Error Codes of Digitizer</td> <td></td> <td></td> <td>Op. mode</td> <td>Zero range</td> <td>Gross Net</td> <td>MD</td> <td>Read command response</td> <td>Cmd Flg</td> </tr> </table>	Error Codes of Digitizer			Op. mode	Zero range	Gross Net	MD	Read command response	Cmd Flg
Error Codes of Digitizer			Op. mode	Zero range	Gross Net	MD	Read command response	Cmd Flg		

### TX 2PB Output to PLC Input 3<sup>rd</sup> Dword

Bit Number	3 <sup>rd</sup> Dword Description		
31 ... 16	Not in use		
15 ... 12	Error Codes of Digitizer	0000	No error found
		0001	ADC out
		0010	ADC over
		0011	ADC under
		0100	System Error
		0101	In programming mode
		0110	Low/High Voltage Error
		0111	Instrument does not found
11 ... 10	Not in use		
9	Operation Mode	0	Weight & Force Mode
		1	Count Mode
8	Zero Range	0	Weight is in zero range
		1	Weight is out of zero range
7	Indication	0	Gross
		1	Net
6	MD – Motion Detection	0	Stable
		1	Dynamic

5 ... 1	Read Command Response	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (floating point type)
		00100	Gross weight (floating point type)
		00101	Tare weight (floating point type)
		10000	Calibration Status (Refer to Table 6.3)
0	CMD Flag	Toggles	The command is applied successfully

### Calibration Status

Bit Number	2 <sup>nd</sup> Dword descriptions when read command is 'Calibration Status'. Refer to PLC Output to TX 2PB Input 3 <sup>rd</sup> Dword		
31 ... 16	Not in use		
15 ... 8	Calibration Errors	0000 0001	Calibration Timeout - Restart calibration
		0000 0010	ADC Error - Re-energize the instrument
		0010 0010	Instrument can not be calibrating - Load cell signal is very low or too high
		0000 0011	Instrument can not be calibrating - Check load cell cable - Re-energize the instrument
		0010 0011	Calibration Error - Calibration test weight is not enough - Increase calibration weight value (Write test weight value to PLC Output to TX 2PB Input 2 <sup>nd</sup> Dword then restart the calibration) - Check load cell connections
		0010 0101	Scale unstable - Wait until scale become stable - Check grounding wiring
7 ... 0	Calibration Process Status	0000 0001	System ready for calibration
		0000 0011	Zero calibration in process
		0000 0100	Span calibration in process
		0000 1001	Error (Calibration Errors )

Table 6.3 - Calibration status

## PLC Output to TX 2PB Input

### Bitwise of Dword:

Dword (R/W)	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

1st Dword	Not in use														
2nd Dword	Next Dword defines the usage of this Dword.														
3rd Dword	Not in use														
	Not in use					Command List					Data Selection				



























## PLC Output to TX 2PB Input 3<sup>rd</sup> Dword

Bit Number	3 <sup>rd</sup> Dword descriptions		
31 ... 11	Not in use		
10 ... 6	Command List	00000	None command is activated
		00001	Zero
		00010	Tare
		00011	Clear
		00101	Adjust zero calibration
		00110	Adjust span calibration (First load 2 <sup>nd</sup> Dword with span test weight value, then apply this command with New CMD)
		01000	Operation mode selection (First load 2 <sup>nd</sup> Dword with selected value, then apply this command with New CMD)
01001	Operation mV of Count Mode (First load 2 <sup>nd</sup> Dword with selected value, then apply this command with New CMD)	Load 2 <sup>nd</sup> Dword with one of these: 0: 5 mV 1: 10 mV 2: 15 mV 3: 18 mV	
01010	Digital Filter (First load 2 <sup>nd</sup> Dword with selected value, then apply this command with New CMD)	Load 2 <sup>nd</sup> Dword with one of these: 0: Fast ... 5: Medium ... 7: Default ... 9: Slow	

5 ... 1	Read Data Selection	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (Floating point)
		00100	Gross weight (Floating point)
		00101	Tare weight (Floating weight)
		10000	Calibration status
0	New CMD	Toggle	Apply commands which are listed in this table

## 6.7. Error Table

The TX 2 load cell signal digitizers have been designed as very reliable and virtually error free instruments. However if an error occurs do not attempt to repair the equipment before you understand what caused the error. Note the problems you have with your instrument and the error messages shown by the LEDs located on the front panel. Then try to solve the problem according to the error table given below.


Error Code			Description	Actions to take / Possible cause
	 →0←	<b>Err</b>		
			ADC Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Over Load	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			Weight is too low	
			ADC Out	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Check the calibration.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			System Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Field bus module error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– Check the field bus module installed on the board.</li> <li>– If seen again, change the board.</li> </ul>
			Board identity error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, re-program the instrument.</li> </ul>
			Internal communication error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the cabling inside the housing.</li> </ul>










○ Blank ● Light ✱ Flash

Table 6.4 - Error table

## 6.8. Diagnostic Tests


RC-232C serial interface tests and load cell signal analog digital conversion&processing tests are performed sequentially in this test menu.

For entering diagnostic test mode, press the programming switch before power on and release the switch after power on the instrument. The instrument will go in to the RS-232C RXD test mode which is indicated by lighted  LED and flashed Err LED as seen below. The status of LEDs on the front panel indicates test steps and the test result as described below. You can go to the next test by pressing the programming switch.

Test	LED's Status			Description
			Err	
RS-232C RxD				LED blanks 0.3 sec after receiving any data. Press programming switch to go next test.
RS-232C TxD				'A' to 'Z' characters are send sequentially in 0.8 s period. If the same data is received,  LED blanks 0.3 sec. Press programming switch to go following test.

 Blank    Light    Flash    Blank for 0.3 second

Table 6.5 - Diagnostic Tests

If you short circuit RXD and TXD pin of the instrument's RS-232C port and go in to TxD test, the receiving data, announced by  LED, indicates the instrument's interface pins have functionality.

Press programming switch for 5 seconds to exit diagnostic test mode and go to operation mode.

# 7. TX 2PN PROFINET

TX 2PN instruments are a state-of-the-art strain gage load cell signal digitizer with Profinet interface. This instrument is used for any type of weighing processes and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

GSDML file is available in CD which is supplied together with the instrument.

## 7.1. Front View

There are 3 annunciater LEDs on front panel to show the instrument status in operation and 3 LEDs (MS, NS, LINK) for showing Profinet status in operation.

The programming switch on front panel of the instrument is used for diagnostic tests (Refer to section 7.8).

The operation mode of the instrument is announced by different lights at stable condition (refer to Table 7.1) and there is no zero indication in count mode operation.

When error LED lightened, other two LED announces the error type. Please refer to Section 7.7 for detailed error descriptions.

Load cell, Profinet, power and serial interface terminals are located at the front of the DIN rail mount instrument as seen in below.

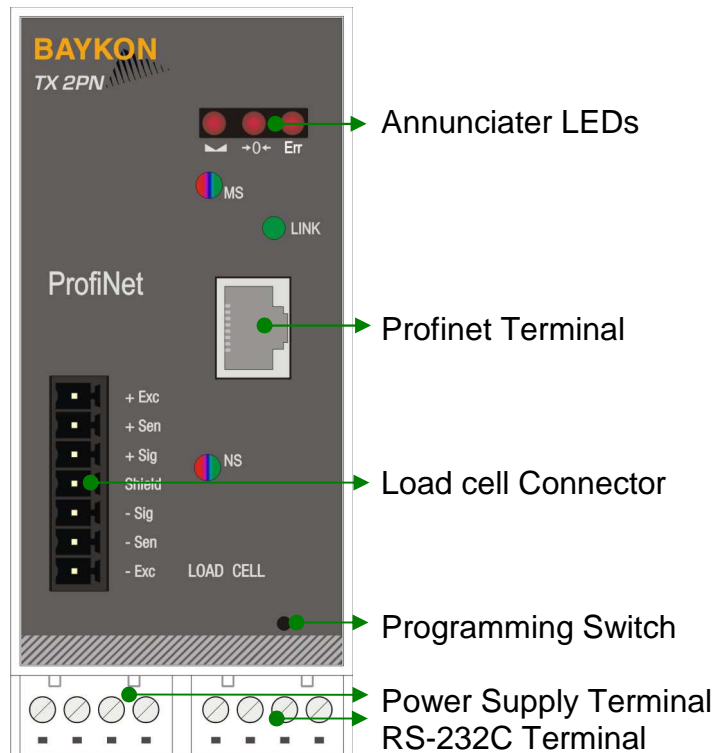


Figure 7.1 - Front view



The meanings of these LEDs in operation are given below.

LED		Operating Mode	
Symbol	Name	Weight / Force	Count
	Stable	<ul style="list-style-type: none"> <li>● Stable</li> <li>○ Unstable ( Dynamic )</li> </ul>	<ul style="list-style-type: none"> <li>⏻ Blanks for 0.3 seconds in 2 seconds period. ( No stable indication )</li> </ul>
	Centre of Zero	<ul style="list-style-type: none"> <li>● in the centre of zero range ( <math>-0.25 e &lt; w &lt; 0.25 e</math> )</li> <li>○ Out of centre of zero range</li> </ul>	<ul style="list-style-type: none"> <li>○ Always blank ( No centre of zero indication )</li> </ul>
Err	Error ( * )	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>✳ Digital processing error</li> <li>○ No error</li> </ul>	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>✳ Digital processing error</li> <li>○ No error</li> </ul>

○ Blank   ● Light   ✳ Flash   ⏻ Blank for 0.3 second

( \* ) : Refer to the error table in Section 7.7.

Table 7.1 - Annunciater LEDs

### MS Module Status LED

LED State	Description	Comment
Off	Not power or not initialized	No power or profinet module is in initialization state
Green	Initialized	
Green, 1 flash	Initialized, diagnostic event(s) present	Diagnostic is active
Red	Exception error	There is an exception error
Red, 1 flash	Configuration Error	Check GSDML configuration
Red, 2 flashes	IP Address Error	IP address not set
Red, 3 flashes	Station Name Error	Station name not set
Red, 4 flashes	Internal Module Error	Re-energize the instrument. If seen again, change the board.

### LINK/Activity LED

LED State	Description	Comment
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

## NS Network Status LED

LED State	Description	Comment
Off	Not online /No power	Check power and cable
Green	On-line (RUN)	-
Green, flashing	On-line (STOP)	-

## 7.2. Electrical Connections

Profinet and RS-232C and power supply terminals are shown in Figure 7.1.

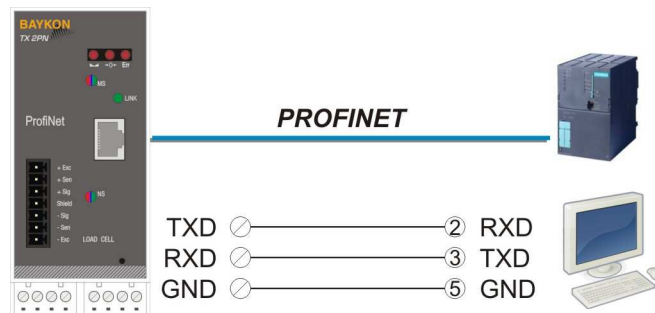


Figure 7.2 - TX 2PN serial interface connections

### RS-232C Serial interface

Usage	Used for service port (xFace)
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1 stop bit

### Profinet interface

Usage	Profinet interface with PC or PLC
Data formats	Profinet
Ethernet	The Ethernet interface operates at 100Mbit, full duplex, as required by Profinet.

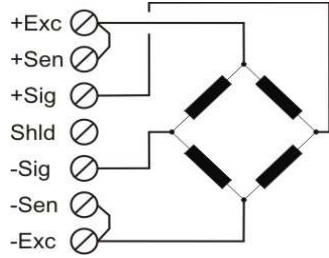
**Warning:** Connect the shield to the reference ground or shield pin of the power connector.

**Warning:** Disconnect xFace PC software for Profinet interfacing.

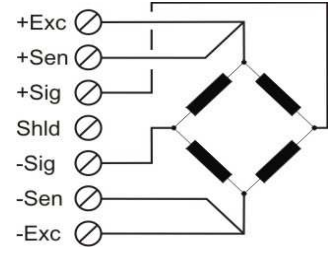
### Load cell Connection:

To avoid damages, the load cell wiring should be made carefully before energizing the instrument. The input resistance of the connected load cells should fit the instrument specification you have. In 4-wire installations the sense and excitation pins with the same polarity should be short circuited at the connector side. If you have junction box in your system, use 6 wire cable between TX 2PN and the junction box, and short circuit these pins at junction box for higher accuracy.

4 wire load cell connection



6 wire load cell connection



**Power Supply Connection:**

The pin configuration of the 24 VDC power supply connector located on front bottom of the instrument is shown in Figure 7.3. Proper grounding is very important for the accuracy and the safety of your measuring system. Before interfering the instrument, please turn off the power and wait at least for 30 seconds.

**Warning:** Connect the shield terminal to the reference ground.

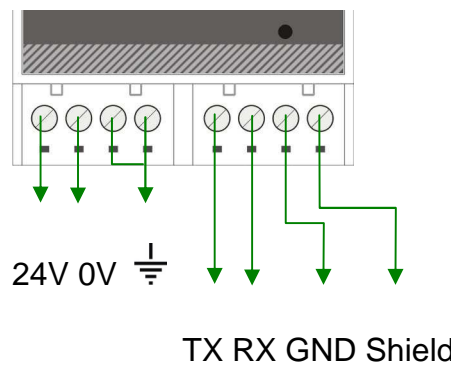


Figure 7.3 - Pin layout of TX 2PN 24VDC connector

**7.3. Interfacing**

TX 2PN instruments have two serial interface connectors on the front of the instruments: Profinet and RS-232C serial interface connector.

TX 2PN instrument interfaces with its peripheral in to programmed data structure. The table below describes the data formats for interfacing the peripherals and their application:

Data Format	Description	Application	Hardware
Profinet	Profinet interfacing. Refer to 'Section 7.6'.	Interfacing with PLC.	Profinet

Table 7.2 - Serial data output interfacing

**Attention:** Please disable the interface you will not use to increase the performance of the instrument.

**7.4. Programming and Calibration**

TX 2 instruments are programmed and calibrated by xFace. Analog digitizer parameter values are very important for better weighing performance. Please refer to Section 4.3.

## 7.5. Profinet Setup

Profinet set up is done by xFace software as described in this section.

Select Gateway tab after connecting xFace to instrument. You will see the Profinet parameters in this tab.

### 7.5.1. Profinet Parameters

There are 7 parameters for Profinet network.

#### **DHCP**

Dynamic Host Configuration Protocol automates network parameters if it is enabled.

*Default is 'Disable'.*

#### **IP Address**

If DHCP is disabled, obtain IP address manually.

*Default is '192.168.16.250'.*

#### **Subnet Mask**

If DHCP is disabled, obtain subnet mask manually.

*Default is '255.255.255.0'.*

#### **Default Gateway**

If DHCP is disabled, obtain default gateway manually.

*Default is '192.168.16.254'.*

#### **Primary DNS**

If DHCP is disabled, obtain primary DNS manually.

*Default is '208.67.222.222'.*

#### **Secondary DNS**

If DHCP is disabled, obtain secondary DNS manually.

*Default is '208.67.220.220'.*

#### **Host Name**

Enter a unique host name to the instrument.

*Default is ''.*

## 7.6. Profinet Data Structure

### TX 2PN Output to PLC Input

#### Bitwise of Dword:

Dword (R/W)	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

1st Dword	Not in use															
2nd Dword	By default, Indicated Weight value is represented. To represent other weight or calibration status, refer to next Dword.															
3rd Dword	Not in use															
	Error Codes of Digitizer							Op. mode	Zero range	Gross Net	MD	Read command response				Cmd Flg

### TX 2PN Output to PLC Input 3<sup>rd</sup> Dword

Bit Number	3 <sup>rd</sup> Dword Description		
31 ... 16	Not in use		
15 ... 12	Error Codes of Digitizer	0000	No error found
		0001	ADC out
		0010	ADC over
		0011	ADC under
		0100	System Error
		0101	In programming mode
		0110	Low/High Voltage Error
		0111	Instrument does not found
11 ... 10	Not in use		
9	Operation Mode	0	Weight & Force Mode
		1	Count Mode
8	Zero Range	0	Weight is in zero range
		1	Weight is out of zero range
7	Indication	0	Gross
		1	Net
6	MD – Motion Detection	0	Stable
		1	Dynamic

5 ... 1	Read Command Response	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (floating point type)
		00100	Gross weight (floating point type)
		00101	Tare weight (floating point type)
		10000	Calibration Status (Refer to Table 7.3)
0	CMD Flag	Toggles	The command is applied successfully

### Calibration Status

Bit Number	2 <sup>nd</sup> Dword descriptions when read command is 'Calibration Status'. Refer to PLC Output to TX 2PN Input 3 <sup>rd</sup> Dword		
31 ... 16	Not in use		
15 ... 8	Calibration Errors	0000 0001	Calibration Timeout - Restart calibration
		0000 0010	ADC Error - Re-energize the instrument
		0010 0010	Instrument can not be calibrating - Load cell signal is very low or too high
		0000 0011	Instrument can not be calibrating - Check load cell cable - Re-energize the instrument
		0010 0011	Calibration Error - Calibration test weight is not enough - Increase calibration weight value (Write test weight value to PLC Output to TX 2PN Input 2 <sup>nd</sup> Dword then restart the calibration) - Check load cell connections
		0010 0101	Scale unstable - Wait until scale become stable - Check grounding wiring
7 .. 0	Calibration Process Status	0000 0001	System ready for calibration
		0000 0011	Zero calibration in process
		0000 0100	Span calibration in process
		0000 1001	Error (Calibration Errors )

Table 7.3 - Calibration status

## PLC Output to TX 2PN Input

### Bitwise of Dword:

Dword (R/W)	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

1st Dword	Not in use			
2nd Dword	Next Dword defines the usage of this Dword.			
3rd Dword	Not in use			
	Not in use		Command List	Data Selection
				New CMD

## PLC Output to TX 2PN Input 3<sup>rd</sup> Dword

Bit Number	3 <sup>rd</sup> Dword descriptions		
31 ... 11	Not in use		
10 ... 6	Command List	00000	None command is activated
		00001	Zero
		00010	Tare
		00011	Clear
		00101	Adjust zero calibration
		00110	Adjust span calibration (First load 2 <sup>nd</sup> Dword with span test weight value, then apply this command with New CMD)
		01000	Operation mode selection (First load 2 <sup>nd</sup> Dword with selected value, then apply this command with New CMD)
01001	Operation mV of Count Mode (First load 2 <sup>nd</sup> Dword with selected value, then apply this command with New CMD)	Load 2 <sup>nd</sup> Dword with one of these: 0: 5 mV 1: 10 mV 2: 15 mV 3: 18 mV	
01010	Digital Filter (First load 2 <sup>nd</sup> Dword with selected value, then apply this command with New CMD)	Load 2 <sup>nd</sup> Dword with one of these: 0: Fast ... 5: Medium ... 7: Default ... 9: Slow	

5 ... 1	Read Data Selection	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (Floating point)
		00100	Gross weight (Floating point)
		00101	Tare weight (Floating weight)
		10000	Calibration status
0	New CMD	Toggle	Apply commands which are listed in this table



## 7.7. Error Table

The TX 2 load cell signal digitizers have been designed as very reliable and virtually error free instruments. However if an error occurs do not attempt to repair the equipment before you understand what caused the error. Note the problems you have with your instrument and the error messages shown by the LEDs located on the front panel. Then try to solve the problem according to the error table given below.


Error Code			Description	Actions to take / Possible cause
		<b>Err</b>		
			ADC Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Over Load	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			Weight is too low	
			ADC Out	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Check the calibration.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			System Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Field bus module error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– Check the field bus module installed on the board.</li> <li>– If seen again, change the board.</li> </ul>
			Board identity error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, re-program the instrument.</li> </ul>
			Internal communication error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the cabling inside the housing.</li> </ul>










Blank   Light   Flash

Table 7.4 - Error table

## 7.8. Diagnostic Tests


RC-232C serial interface tests and load cell signal analog digital conversion&processing tests are performed sequentially in this test menu.

For entering diagnostic test mode, press the programming switch before power on and release the switch after power on the instrument. The instrument will go in to the RS-232C RXD test mode which is indicated by lighted  LED and flashed Err LED as seen below. The status of LEDs on the front panel indicates test steps and the test result as described below. You can go to the next test by pressing the programming switch.

Test	LED's Status			Description
			Err	
RS-232C RxD				LED blanks 0.3 sec after receiving any data. Press programming switch to go next test.
RS-232C TxD				'A' to 'Z' characters are send sequentially in 0.8 s period. If the same data is received,  LED blanks 0.3 sec. Press programming switch to go following test.

 Blank    Light    Flash    Blank for 0.3 second

Table 7.5 - Diagnostic Tests

If you short circuit RXD and TXD pin of the instrument's RS-232C port and go in to TxD test, the receiving data, announced by  LED, indicates the instrument's interface pins have functionality.

Press programming switch for 5 seconds to exit diagnostic test mode and go to operation mode.

## 8. TX 2EN ETHERNET

TX 2EN instruments are a state-of-the-art strain gage load cell signal digitizer with Ethernet interface. This instrument is used for any type of weighing processes and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

### 8.1. Front View

There are 3 annunciater LEDs on front panel to show the instrument status in operation.

The programming switch on front panel of the instrument is used for diagnostic tests (refer to Section 8.8).

The operation mode of the instrument is announced by different lights at stable condition (refer to Table 8.1) and there is no zero indication in count mode operation.

When error LED lightened, other two LED announces the error type. Please refer to Section 8.7 for detailed error descriptions.

Load cell, Ethernet, power and serial interface terminals are located at the front of the DIN rail mount instrument as seen in below.

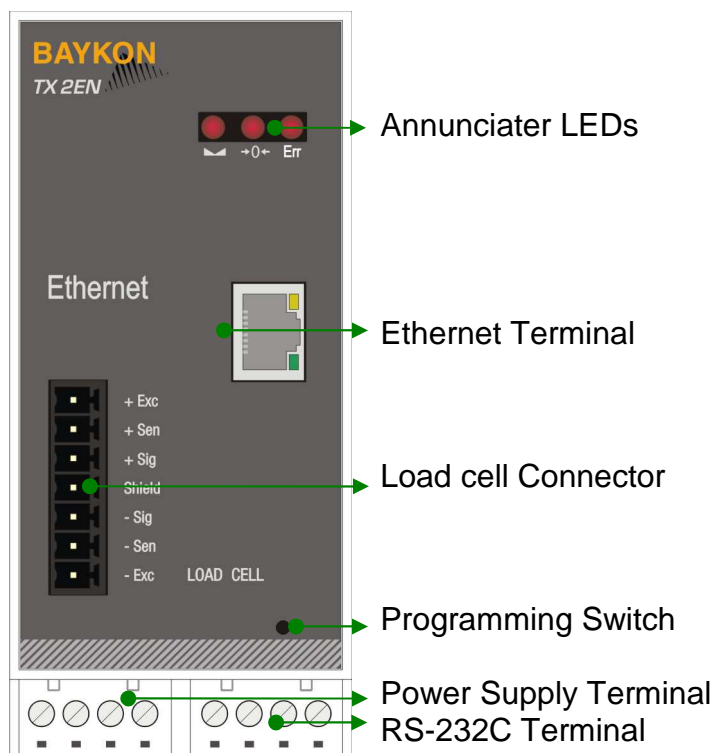


Figure 8.1 - Front view

The meanings of these LEDs in operation are given below.

LED		Operating Mode	
Symbol	Name	Weight / Force	Count
	Stable	<ul style="list-style-type: none"> <li>● Stable</li> <li>○ Unstable ( Dynamic )</li> </ul>	<ul style="list-style-type: none"> <li>⏻ Blanks for 0.3 seconds in 2 seconds period. ( No stable indication )</li> </ul>
	Centre of Zero	<ul style="list-style-type: none"> <li>● in the centre of zero range ( <math>-0.25 e &lt; w &lt; 0.25 e</math> )</li> <li>○ Out of centre of zero range</li> </ul>	<ul style="list-style-type: none"> <li>○ Always blank ( No centre of zero indication )</li> </ul>
Err	Error ( * )	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>⚡ Digital processing error</li> <li>○ No error</li> </ul>	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>⚡ Digital processing error</li> <li>○ No error</li> </ul>

○ Blank ● Light ⚡ Flash ⏻ Blank for 0.3 second

( \* ) : Refer to the error table in Section 8.7.

Table 8.1 - Annunciater LEDs

## 8.2. Electrical Connections

Ethernet and RS-232C and power supply terminals are shown in Figure 8.1.

### Ethernet Connector (RJ45)

Pin	Signal	DIR	Description
1	TX+	Out	Differential Ethernet transmit data +
2	TX-	Out	Differential Ethernet transmit data -
3	RX+	In	Differential Ethernet receive data +
6	RX-	In	Differential Ethernet receive data -
4	Not used		Terminated
5	Not used		Terminated
7	Not used		Terminated
8	Not used		Terminated
	Shield		Chasis ground

The HUB connection cabling will be a direct connection as shown below:

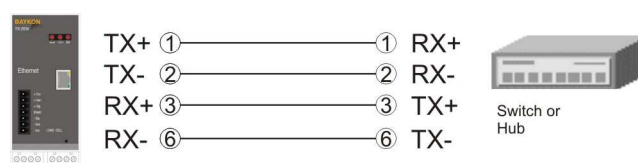


Figure 8.2 - HUB connection

The PC connection cabling will be done via cross cable as shown below:

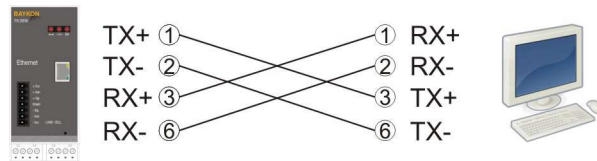


Figure 8.3 - Cross PC connection

TX 2EN serial interface connections are shown below:

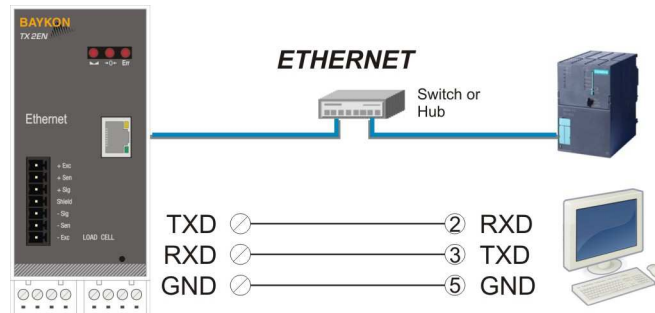


Figure 8.4 - TX 2EN serial interface connections

### RS-232C Serial interface

Usage	Interfacing with PC and PLC, programming via xFace
Data formats	BSI (Default), Continuous, Modbus RTU High-Low, Modbus RTU Low-High
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1 stop bit

### Ethernet interface

Usage	Ethernet interface with PC or PLC
Data formats	BSI, Continuous, Modbus TCP/IP High-Low (Default), Modbus TCP/IP Low-High
Ethernet	The Ethernet interface operates at 10Mbit, half duplex

**Warning:** Connect the shield to the reference ground or shield pin of the power connector.

**Warning:** Disconnect xFace PC software for Ethernet interfacing.

### Load cell Connection:

To avoid damages, the load cell wiring should be made carefully before energizing the instrument. The input resistance of the connected load cells should fit the instrument specification you have. In 4-wire installations the sense and excitation pins with the same polarity should be short circuited at the connector side. If you have junction box in your system, use 6 wire cable between TX 2EN and the junction box, and short circuit these pins at junction box for higher accuracy.



Figure 8.5 - Load cell connection

**Power Supply Connection:**

The pin configuration of the 24 VDC power supply connector located on front bottom of the instrument is shown in next Figure. Proper grounding is very important for the accuracy and the safety of your measuring system. Before interfering the instrument, please turn off the power and wait at least for 30 seconds.

**Warning:** Connect the shield terminal to the reference ground.

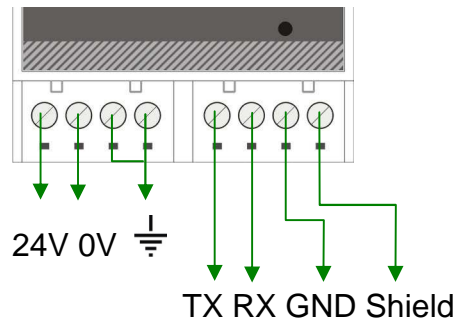


Figure 8.6 - Pin layout of TX 2EN 24VDC connector

**8.3. Interfacing**

TX 2EN instruments have two serial interface connectors on the front of the instruments: Ethernet and RS-232C serial interface connector.

TX 2 instruments interface with its peripheral in to programmed data structure. The table below describes the data formats for interfacing the peripherals and their application:

Data Format	Description	Application	Hardware
Continuous	Asynchronous continuous data format. Refer to 'Section 4.9'.	Continuous data transfer to PC or PLC Remote display connection Remote Taring, Zeroing	RS-232C Ethernet
BSI	Demand interface on BSI Serial Interface format. Refer to 'Section 4.10'	Master – Slave data interfacing with PLC or PC.	RS-232C Ethernet
Modbus RTU High-Low	Modbus interfacing. Refer to 'Section 5.6'.	Interfacing with PLC.	RS-232C
Modbus RTU Low-High	Modbus interfacing. Refer to 'Section 5.6'.	Interfacing with PLC.	RS-232C
Modbus TCP/IP High-Low	Ethernet interfacing. Refer to 'Section 8.6'.	Interfacing with PLC.	Ethernet

Modbus TCP/IP Low- High	Ethernet interfacing. Refer to 'Section 8.6'.	Interfacing with PLC.	Ethernet
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Table 8.2 - Serial data output interfacing

**Attention:** Please disable the interface you will not use to increase the performance of the instrument.

## 8.4. Programming and Calibration

TX 2 instruments are programmed and calibrated by xFace. Analog digitizer parameter values are very important for better weighing performance. Please refer to Section 4.3.

## 8.5. Ethernet Setup

Ethernet set up is done by xFace software as described in this section.

Select Gateway tab after connecting xFace to instrument. You will see the Ethernet parameters in this tab.

### 8.5.1. Ethernet Parameters

There are 11 parameters for Ethernet network.

#### Host Name

Device name of the instrument.

*Default is ' '.*

#### Data Format

This parameter programs the Ethernet port data format. The available data formats are;

Disable : No data will be transmitted. Select disable if this port is not used.

Continuous : The data is transmitted continuously. Refer to *Section 4.9* for details.

BSI : Communicates in BSI format as a slave. Refer to *Section 4.10* for details.

Modbus TCP/IP High-Low : Modbus TCP/IP communication. Refer to 'Section 8.6' for details.

Modbus TCP/IP Low-High : Modbus TCP/IP communication. Refer to 'Section 8.6' for details.

Default is *Modbus TCP/IP High-Low*

**IP Address**

Obtain IP address manually.

*Default is '192.168.16.250'.*

**Local Port**

Ethernet connection port of the instrument.

*Default is '10001'.*

**Gateway**

Network point that acts as an entrance to another network.

*Default is '192.168.16.254'.*

**Subnet Mask**

Describes IP address can be used in network.

*Default is '255.255.255.0'.*

**Primary DNS**

Obtain primary DNS manually.

*Default is '208.67.222.222'.*

**Secondary DNS**

Obtain secondary DNS manually.

*Default is '208.67.220.220'.*

**Remote Connection**

Automatic connection to any device on the network.

Default is 'Disabled'.

**Remote IP** : IP address of the PC or Device to be connected automatically.

**Remote Port** : Ethernet connection point of PC or Device to be connected automatically.



## 8.6. Ethernet Data Structure

If the instrument is programmed for Modbus TCP/IP, it can be used as a Modbus TCP/IP slave on Ethernet communication network. Functions code '0x03' and '0x10' are supported.

### Modbus TCP/IP Command Table;

Address	R/W	Word	Command	Definition			
40001	R	2	Weight / Force / Count Data				
40003	R	1	Status	D0	0 – System Ready	1 – System Busy	
				D1	0 – Error	1 – Data ok	
				D2	0 – Weight Stable	1 – Weight unstable	
				D3	0 – Gross Mode	1 – Net mode	
				D4	0	Not Used	
				D5	0 – Weight / Force	1 – Count Mode	
				D6	0	Not used	
				D7	0		
				D8	0		
				D9	0		
				D10	0		
				D11	0		
				D12	0 – Out of zero range	1 – Weight is in zero range	
				D13	Error Code	0	No Errors
				D14		1	ADC out of range
D15	2	ADC over range					
	3	ADC under range					
	4	System error					
	5	In programming mode					
	6	Low/High voltage det.					
40004	R	2	Tare weight				
40006	R	2	Gross weight				
40008	R	1	Status	Motion, Net mode, Data ok, (image of register 40003)			
40009	R/W	1	Control	0	None		
				1	Zero		
				2	Tare		
				3	Clear		
40010	R/W	1	Calibration	0	None		
				188	Adjust Zero Calibration		
				220	Adjust Span Calibration (First load 40011 with span test weight value)		
40011	R/W	2	Span Calibration Value				

40013	R	1	Calibration Status	D0 .. D7	1	Ready for calibration	
					3	Zero calibration in process	
					4	Span calibration in process	
					9	Error (Refer to D8 ... D15 )	
				D8 .. D15	Calibration Errors	1	Calibration Timeout - Restart calibration
						2	ADC Error - Re-energize the instrument - If seen again, change the board.
						3	Instrument can not be calibrating - Check load cell cable - Re-energize the instrument
						34	Instrument can not be calibrating - Load cell signal is very low or too high
						35	Calibration Error - Calibration test weight is not enough - Increase calibration weight value (40011) - Check load cell connections
						37	Scale unstable - Wait until scale become stable - Check grounding wiring
40014	R/W	1	Operation Mode Select	0	Count Mode Unipolar		
				1	Count Mode Bipolar		
				2	Force Mode Unipolar		
				3	Force Mode Bipolar		
				4	Weight Mode Unipolar		
40015	R/W	1	Operation mV of Count Mode	0	5 mV		
				1	10 mV		
				2	15 mV		
				3	18 mV		
40016	R/W	1	Digital Filters	0	Fast		
				1			
				2			
				3			
				4			
				5	Medium		
				6			
				7	Default		
				8			
				9	Slow		
40034	R	1	Voltage of Power Supply	Voltage of power supply is indicated with 0.1 V increment. For example: 23.4 VDC is indicated as integer 234 value.			

## EXPLANATION:

Attention: For hardware connection details, please refer to the related hardware descriptions in this manual.

**Modbus TCP/IP High-Low:** In two word registers, the data is stored to the registers in big-endian format. Least significant word is stored to the highest register address; and most significant word is stored to the lowest register address.

**Modbus TCP/IP Low-High:** In two word registers, the data is stored to the registers in little-endian format. Least significant word is stored to the lowest register address; and most significant word is stored to the highest register address.

Please find Modbus information in the web site of <http://www.modbus.org>

## Examples:

Performing Read and Write operations according (Modbus TCP/IP High-Low) to hex system. MBAP (Modbus Application Protocol) Header is not included to the below Modbus TCP/IP application data units.

Request weight data	: 03,00,00,00,02
Answer of request weight	: 03,04,00,01,86,A0
Weight is 100000	
Request status data	: 03,00,02,00,01
Taring	: 10,00,08,00,01,02,00,02
Request tare data	: 03,00,03,00,02
Answer of request tare	: 03,04,00,00,27,10
Tare is 10000	
Weight Mode Selection	: 10,00,0D,00,01,02,00,04
Count in Unipolar Mode Selection	: 10,00,0D,00,01,02,00,00
5 mV Input signal range selection	: 10,00,0E,00,01,02,00,00
Load Medium (5) to Digital filter	: 10,00,0F,00,01,02,00,05
Request Calibration Status	: 03,00,0C,00,01
Answer of request Calibration Status	: 03,02,00,01
Instrument is ready for calibration	
Zero Calibration Command	: 10,00,08,00,01,02,00,01
Span Calibration with Span Value 50000	:10,00,09,00,03,06,00,DC,00,00,C3,50

## 8.7. Error Table

The TX 2 load cell signal digitizers have been designed as very reliable and virtually error free instruments. However if an error occurs do not attempt to repair the equipment before you understand what caused the error. Note the problems you have with your instrument and the error messages shown by the LEDs located on the front panel. Then try to solve the problem according to the error table given below.


Error Code			Description	Actions to take / Possible cause
		<b>Err</b>		
			ADC Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Over Load	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			Weight is too low	
			ADC Out	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Check the calibration.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			System Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Board identity error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, re-program the instrument.</li> </ul>
			Internal communication error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the cabling inside the housing.</li> </ul>











Blank   Light   Flash

Table 8.3 - Error table

## 8.8. Diagnostic Tests


RC-232C serial interface tests and load cell signal analog digital conversion&processing tests are performed sequentially in this test menu.

For entering diagnostic test mode, press the programming switch before power on and release the switch after power on the instrument. The instrument will go in to the RS-232C RXD test mode which is indicated by lighted  LED and flashed Err LED as seen below. The status of LEDs on the front panel indicates test steps and the test result as described below. You can go to the next test by pressing the programming switch.

Test	LED's Status			Description
			Err	
RS-232C RxD				 LED blanks 0.3 sec after receiving any data. Press programming switch to go next test.
RS-232C TxD				'A' to 'Z' characters are send sequentially in 0.8 s period. If the same data is received,  LED blanks 0.3 sec. Press programming switch to go following test.

 Blank    Light    Flash    Blank for 0.3 second

Table 8.4 - Diagnostic Tests

If you short circuit RXD and TXD pin of the instrument's RS-232C port and go in to TxD test, the receiving data, announced by  LED, indicates the instrument's interface pins have functionality.

Press programming switch for 5 seconds to exit diagnostic test mode and go to operation mode.

# 9. TX 2CO CANopen

TX 2CO instruments are a state-of-the-art strain gage load cell signal digitizer with CANopen interface. This instrument is used for any type of weighing processes and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

EDS file is available in CD which is supplied together with the instrument.

## 9.1. Front View

There are 3 annunciator LEDs on front panel to show the instrument status in operation and 2 LEDs (ST, OP) for showing CANopen status in operation.

The programming switch on front panel of the instrument is used for CANopen addressing without PC (refer to Section 4.7) and for diagnostic tests (refer to section 9.8).

The operation mode of the instrument is announced by different lights at stable condition (refer to Table 9.1) and there is no zero indication in count mode operation.

When error LED lightened, other two LED announces the error type. Please refer to Section 9.7 for detailed error descriptions.

Load cell, CANopen, power and serial interface terminals are located at the front of the DIN rail mount instrument as seen in below.

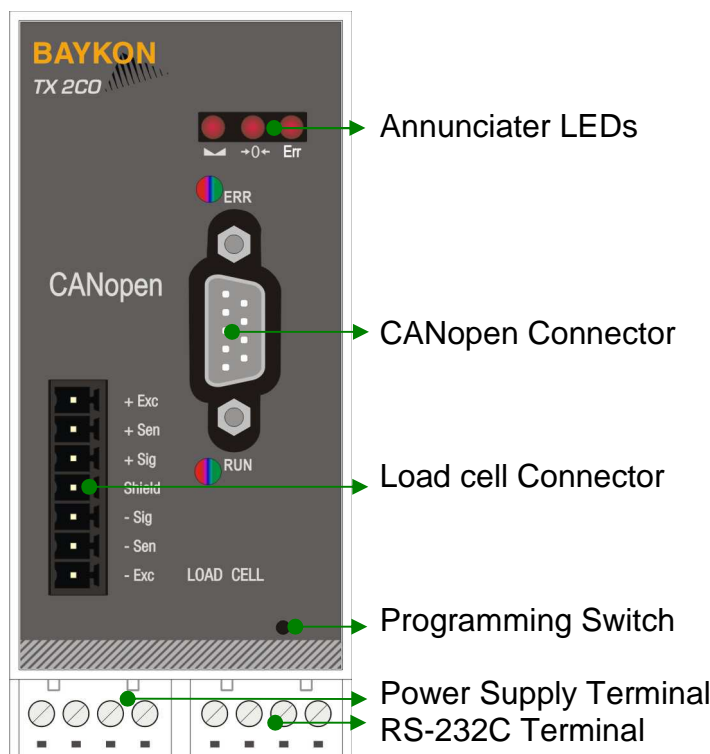


Figure 9.1 - Front view

The meanings of these LEDs in operation are given below.

LED		Operating Mode	
Symbol	Name	Weight / Force	Count
	Stable	<ul style="list-style-type: none"> <li>● Stable</li> <li>○ Unstable ( Dynamic )</li> </ul>	<ul style="list-style-type: none"> <li>⏻ Blanks for 0.3 seconds in 2 seconds period. ( No stable indication )</li> </ul>
	Centre of Zero	<ul style="list-style-type: none"> <li>● in the centre of zero range ( <math>-0.25 e &lt; w &lt; 0.25 e</math> )</li> <li>○ Out of centre of zero range</li> </ul>	<ul style="list-style-type: none"> <li>○ Always blank ( No centre of zero indication )</li> </ul>
Err	Error ( * )	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>✳ Digital processing error</li> <li>○ No error</li> </ul>	<ul style="list-style-type: none"> <li>● ADC conversion error</li> <li>✳ Digital processing error</li> <li>○ No error</li> </ul>

○ Blank   ● Light   ✳ Flash   ⏻ Blank for 0.3 second

( \* ) : Refer to the error table in Section 9.7.

Table 9.1 - Annunciater LEDs

### Run LED

State	Indication	Comment
Off	Not online /No power	Check power and cable
Green	On-line, data exchange	-
Green, blinking	On-line, initializing	-
Green, single flash	Stopped	Check hardware damages
Green, flickering	Auto baudrate detection in progress	-
Red	CANopen configuration error	Check EDS file

### Error LED

State	Indication	Comment
Off	-	No power or CANopen module is in initialization state
Red, single flash	Warning limit reached	A bus error counter reached or exceeded its warning level
Red, flickering	LSS	LSS services in progress
Red, double flash	Error count event	A guard- (NMT-Slave or NMT-master) or heartbeat event (Heartbeat consumer) has occurred.
Red	Bus off (Fatal Event)	Bus off.

## 9.2. Electrical Connections

CANopen, RS-232C and power supply terminals are shown in Figure 9.1.

### CANopen Connector (DB9F)

Pin	Signal	Description
1	-	-
2	CAN_L	-
3	CAN_GND	-
4	-	-
5	CAN_SHIELD	-
6	-	-
7	CAN_H	-
8	-	-
9	-	-
Housing	Cable Shield	-

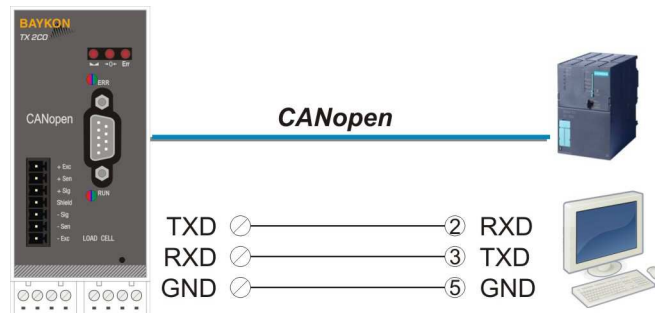


Figure 9.2 - TX 2CO serial interface connections

### RS-232C Serial interface

Usage	Used for service port (xFace)
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1 stop bit

### CANopen interface

Usage	Interfacing with PC or PLC
Data formats	CANopen
Baud rate	Automatically detected and supported baud rates are 10 kbps, 50 kbps, 100 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps, Autobaud (default).

**Warning:** Connect the shield to the reference ground or shield pin of the power connector.

**Warning:** Disconnect xFace PC software for CANopen interfacing.



### Load cell Connection:

To avoid damages, the load cell wiring should be made carefully before energizing the instrument. The input resistance of the connected load cells should fit the instrument specification you have. In 4-wire installations the sense and excitation pins with the same polarity should be short circuited at the connector side. If you have junction box in your system, use 6 wire cable between TX 2CO and the junction box, and short circuit these pins at junction box for higher accuracy.

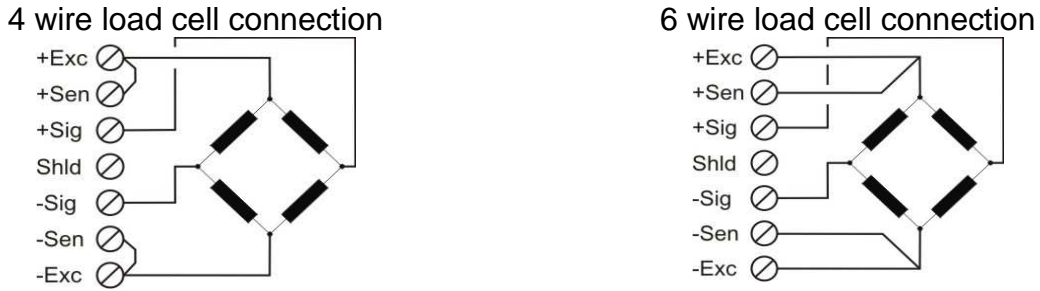


Figure 9.3 - Load cell connection

### Power Supply Connection:

The pin configuration of the 24 VDC power supply connector located on front bottom of the instrument is shown in Figure 9.4. Proper grounding is very important for the accuracy and the safety of your measuring system. Before interfering the instrument, please turn off the power and wait at least for 30 seconds.

**Warning:** Connect the shield terminal to the reference ground.

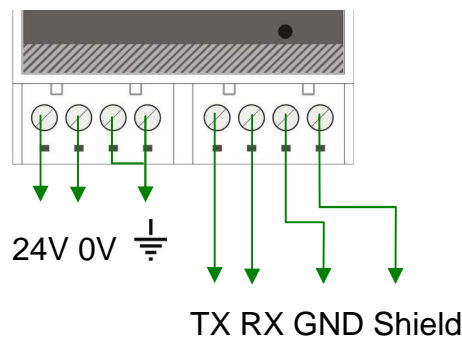


Figure 9.4 - Pin layout of TX 2CO 24VDC connector

### 9.3. Interfacing

TX 2CO instruments have two serial interface connectors on the front of the instruments: CANopen and RS-232C serial interface connector.

TX 2CO instrument interfaces with its peripheral in to programmed data structure. The table below describes the data formats for interfacing the peripherals and their application:

Data Format	Description	Application	Hardware
CANopen	CANopen interfacing. Refer to 'Section 9.6'.	Interfacing with PLC.	CANopen

Table 9.2 - Serial data output interfacing

**Attention:** Please disable the interface you will not use to increase the performance of the instrument.

### 9.4. Programming and Calibration

TX 2 instruments are programmed and calibrated by xFace. Analog digitizer parameter values are very important for better weighing performance. Please refer to Section 4.3.

### 9.5. CANopen Setup

CANopen set up is done by xFace software as described in this section.

Select Gateway tab after connecting xFace to instrument. You will see the CANopen parameters in this tab.

#### 9.5.1. CANopen Parameters

There is only one parameter for CANopen network.

##### **CANopen Rack Address**

The address range is 1 to 127.

*Default is '01'.*

## 9.6. CANopen Data Structure

### TX 2CO Output to PLC Input

#### Bitwise of Dword:

Dword (R/W)	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

TxPDO 1 (T_DW1)	Not in use															
TxPDO 2 (T_DW2)	By default, Indicated Weight value is represented. To represent other weight or calibration status, refer to next Dword.															
TxPDO 3 (T_DW3)	Not in use															
	Error Codes of Digitizer							Op. mode	Zero range	Gross Net	MD	Read command response				Cmd Flg

### TX 2CO Output to PLC Input T\_DW3

Bit Number	TxPDO 3 (T_DW3) Description		
31 ... 16	Not in use		
15 ... 12	Error Codes of Digitizer	0000	No error found
		0001	ADC out
		0010	ADC over
		0011	ADC under
		0100	System Error
		0101	In programming mode
		0110	Low/High Voltage Error
0111	Instrument does not found		
11 ... 10	Not in use		
9	Operation Mode	0	Weight & Force Mode
		1	Count Mode
8	Zero Range	0	Weight is in zero range
		1	Weight is out of zero range
7	Indication	0	Gross
		1	Net
6	MD – Motion Detection	0	Stable
		1	Dynamic

5 ... 1	Read Command Response	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (floating point type)
		00100	Gross weight (floating point type)
		00101	Tare weight (floating point type)
		10000	Calibration Status (Refer to Table 6.3)
0	CMD Flag	Toggles	The command is applied successfully

### Calibration Status

Bit Number	TxPDO 2 (T_DW2) descriptions when read command is 'Calibration Status'. Refer to PLC Output to TX 2CO Input R_DW3		
31 ... 16	Not in use		
15 ... 8	Calibration Errors	0000 0001	Calibration Timeout - Restart calibration
		0000 0010	ADC Error - Re-energize the instrument
		0010 0010	Instrument can not be calibrating - Load cell signal is very low or too high
		0000 0011	Instrument can not be calibrating - Check load cell cable - Re-energize the instrument
		0010 0011	Calibration Error - Calibration test weight is not enough - Increase calibration weight value (Write test weight value to PLC Output to TX 2CO Input R_DW2 then restart the calibration) - Check load cell connections
		0010 0101	Scale unstable - Wait until scale become stable - Check grounding wiring
7 .. 0	Calibration Process Status	0000 0001	System ready for calibration
		0000 0011	Zero calibration in process
		0000 0100	Span calibration in process
		0000 1001	Error (Calibration Errors )

Table 9.3 - Calibration status

## PLC Output to TX 2CO Input

### Bitwise of Dword:

Dword (R/W)	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

RxPDO 1 (R_DW1)	Not in use														
RxPDO 2 (R_DW2)	Next Dword defines the usage of this Dword.														
RxPDO 3 (R_DW3)	Not in use														
	Not in use					Command List					Data Selection				



























## PLC Output to TX 2CO Input R\_DW3

Bit Number	RxPDO 3 (R_DW3) descriptions			
31 ... 11	Not in use			
10 ... 6	Command List	00000	None command is activated	
		00001	Zero	
		00010	Tare	
		00011	Clear	
		00101	Adjust zero calibration	
		00110	Adjust span calibration (First load R_DW2 with span test weight value, then apply this command with New CMD)	
		01000	Operation mode selection (First load R_DW2 with selected value, then apply this command with New CMD)	Load R_DW2 with one of these: 0: Count mode unipolar 1: Count mode bipolar 2: Force mode unipolar 3: Force mode bipolar 4: Weight mode unipolar
		01001	Operation mV of Count Mode (First load R_DW2 with selected value, then apply this command with New CMD)	Load R_DW2 with one of these: 0: 5 mV 1: 10 mV 2: 15 mV 3: 18 mV
01010	Digital Filter (First load R_DW2 with selected value, then apply this command with New CMD)	Load R_DW2 with one of these: 0: Fast ... 5: Medium ... 7: Default ... 9: Slow		

5 ... 1	Read Data Selection	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (Floating point)
		00100	Gross weight (Floating point)
		00101	Tare weight (Floating weight)
		10000	Calibration status
0	New CMD	Toggle	Apply commands which are listed in this table

## 9.7. Error Table

The TX 2 load cell signal digitizers have been designed as very reliable and virtually error free instruments. However if an error occurs do not attempt to repair the equipment before you understand what caused the error. Note the problems you have with your instrument and the error messages shown by the LEDs located on the front panel. Then try to solve the problem according to the error table given below.


Error Code			Description	Actions to take / Possible cause
	 →0←	<b>Err</b>		
			ADC Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Over Load	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			Weight is too low	
			ADC Out	<ul style="list-style-type: none"> <li>– Check the load.</li> <li>– Check the calibration.</li> <li>– Load cell or instrument could be defective.</li> </ul>
			System Error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the board.</li> </ul>
			Field bus module error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– Check the field bus module installed on the board.</li> <li>– If seen again, change the board.</li> </ul>
			Board identity error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, re-program the instrument.</li> </ul>
			Internal communication error	<ul style="list-style-type: none"> <li>– Re-energize the instrument.</li> <li>– If seen again, change the cabling inside the housing.</li> </ul>










○ Blank ● Light ✱ Flash

Table 9.4 - Error table

## 9.8. Diagnostic Tests


RC-232C serial interface tests and load cell signal analog digital conversion&processing tests are performed sequentially in this test menu.

For entering diagnostic test mode, press the programming switch before power on and release the switch after power on the instrument. The instrument will go in to the RS-232C RXD test mode which is indicated by lighted  LED and flashed Err LED as seen below. The status of LEDs on the front panel indicates test steps and the test result as described below. You can go to the next test by pressing the programming switch.

Test	LED's Status			Description
			Err	
RS-232C RxD				LED blanks 0.3 sec after receiving any data. Press programming switch to go next test.
RS-232C TxD				'A' to 'Z' characters are send sequentially in 0.8 s period. If the same data is received,  LED blanks 0.3 sec. Press programming switch to go following test.

 Blank    Light    Flash    Blank for 0.3 second

Table 9.5 - Diagnostic Tests

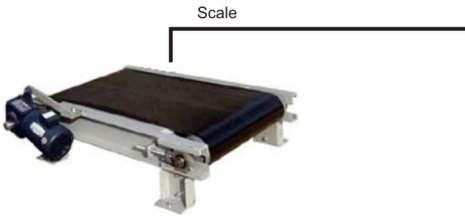
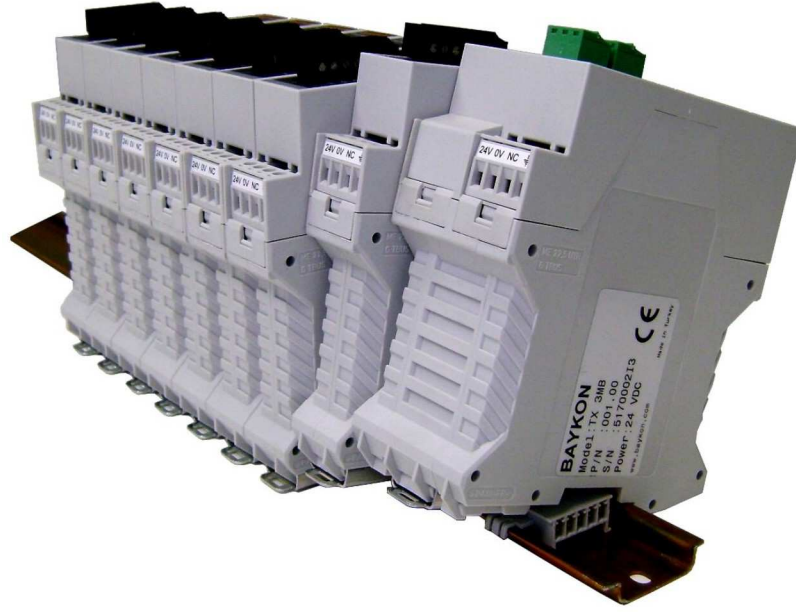
If you short circuit RXD and TXD pin of the instrument's RS-232C port and go in to TxD test, the receiving data, announced by  LED, indicates the instrument's interface pins have functionality.

Press programming switch for 5 seconds to exit diagnostic test mode and go to operation mode.



## 10. FREQUENTLY ASKED QUESTIONS

Question : My PC could not interface with TX 2. How can I check the com port?
Answer : – Connect the instrument to the PC and run Hyper Terminal. – Check com ports as described in Diagnostic Test section.
Question : xFace installation needs restart every time. How can I install it?
Answer : – Read and follow the installation notes in the installation directory. – Update your computer (visit <a href="http://update.microsoft.com">http://update.microsoft.com</a> ).
Question : xFace could not connect to instrument. What can I do?
Answer : – Check the power, data cabling and LED status of the TX 2 instrument. – Check PC port setting. – Remove other connections. Re-energize the TX 2 instrument and then make connection.
Question : My PC doesn't have any COM port. How can I connect transmitter to my PC?
Answer : You can use RS-232 / USB converter for serial interfacing via USB port. And select com port with Connection Settings menu.
Question : My PC have a COM port but I couldn't see COM port in Connection Setting menu. How can I solve that problem?
Answer : Another software may be connected to that COM port. Close all applications before running xFace.
Question : My PC could not interface with TX 2. How can I check the com ports?
Answer : Short circuit your com port RXD and TXD pins. Check if the sending data is received or not by using any terminal software. You may test also TX 2 com ports as described in Diagnostic Tests section by short circuiting RXD and TXD terminals.
Question : I need very fast interfacing. What is the response delay time of TX 2AD
Answer : TX 2 response delay is max. 4 milliseconds for weight data. Extremely fast interfacing.
Question : What is the external conversion rate of TX 2?
Answer : Only continuous data output rate might be called as an external conversion rate which is depend on the baudrate and data length and up to 65 conversion/second.
Question : How can I check Ethernet connection?
Answer : – TX 2EN has a dummy web page. You can easily open web page with any browser installed on any PC in network.



RS-232C  
RS-485  
Modbus RTU  
Ethernet TCP/IP  
Modbus TCP/IP  
Profibus DP  
Profinet  
CANopen



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