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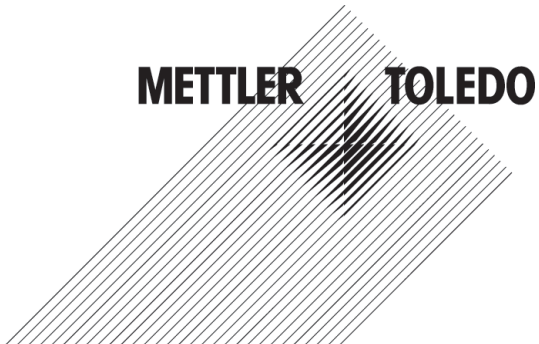
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GARVENS
Checkweighing

X-Series System Manual Part 7:

Interfaces and data communication



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1 Interfaces

1.1 Overview of the interfaces

If the system has to be equipped with an interface that is accessible from the outside, a corresponding connector is located as an extension of the XRTC connection in the bottom of the control cabinet in the region of the cable glands as a rule.

1.1.1 IPC module with 15" weighing terminal (XS)

All the interfaces are located on the IPC unit of the X-Series. Depending on the design this is mounted on the control cabinet door or at a different location within the control cabinet.

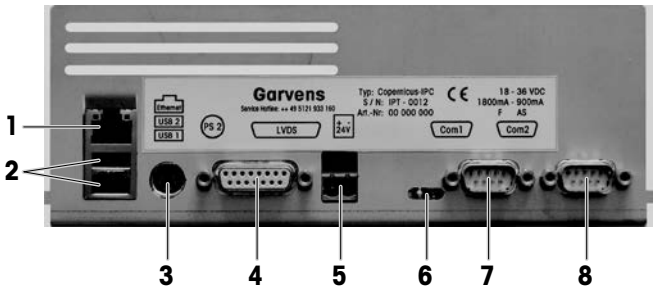


Fig. 1: Overview of interfaces and connections

1 Ethernet
2 USB (2x)
3 PS2 keyboard connection
4 HMI (terminal connection)
5 24 V DC
6 LED indicator 12 V/5 V
7 Serial interface COM1 IPC
8 Serial interface COM2 IPC

1.1.2 Weighing terminal 7" (XE Widescreen)

All the interfaces are located directly at the terminal in the inside of the control cabinet and can be accessed after the cabinet door has been opened.

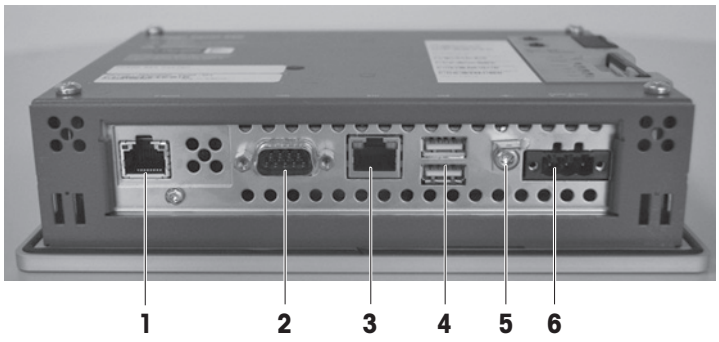


Fig. 2: Overview of interfaces and connections

1 Ethernet Interface 1
2 RS 232
3 Ethernet Interface 2
4 USB (2x)
5 Grounding connection
6 24 VDC

1.1.3 XRTC module

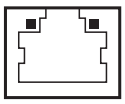
All the interfaces are located directly at the XRTC in the inside of the control cabinet and can be accessed after the cabinet door has been opened.



Fig. 3: Overview of interfaces and connections

1 USB (only service)
2 Ethernet (2x)
3 Serial interface COM1 XRTC
4 Serial interface COM2 XRTC

1.2 Ethernet



If the weighing unit is equipped with an Ethernet interface, the corresponding plug and socket are normally located on the floor of the switch cabinet among the threaded cable connections as an extension of the IPC Ethernet connection with the designation X20.

The Ethernet interface is accessible without opening the switch cabinet and is additionally protected by a cover when not in use.

A link is indicated by a steady illuminated yellow LED, data transfer (active) by means of a green LED (flashing during data transfer).

1.3 USB



Both USB interfaces (USB1 and USB2), which function identically, comply with the USB 2.0 specification and are located on the X-Series weighing terminal in the control cabinet.

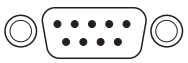
If more USB connections are required, a USB connection can be extended by using a USB hub. The technical design of this hub is the responsibility of METTLER TOLEDO Garvens.

1.4 PS2 keyboard connection (only 15" terminal)



A standard external keyboard can be connected to the X-Series IPC for servicing purposes. A USB connection can be used alternatively.

1.5 Serial interfaces COM1 and COM2 or COM



The 15" terminal has two serial interface connections (COM1 IPC and COM2 IPC), the 7" terminal one serial interface (COM) for the data output and device connection.

In addition further interfaces are available on the XRTC module (COM1 XRTC, COM2 XRTC).

The factory version of the serial interface at the 7" terminal (COM) is always V24/RS232C and cannot be converted.

The interface adapters "COM1" and "COM2" were equipped customer-specifically for the required interface type. If no specification was made, no interface is equipped.

Several interface types are possible at the 15" terminal and in the XRTC module, depending on the equipment used:

- V24/RS232C interface with or without handshake lines, with a maximum transmission length of 10 m
- CL20 interface (line current 20 mA) active or passive, with a maximum transmission length of 1000 m
- RS-422-A interface with a maximum transmission length of 1000 m
- RS-485 interface with a maximum transmission length of 1000 m

Note
All distance specifications are based on suitable cables and cable routing.

1.5.1 Configuring an interface

Note
It is imperative that the cable shielding be connected to the connector housing (metal surfaces) when the connector is mounted so that a low-impedance contact is ensured when the connector and socket are screwed together.



CAUTION

Possible damage

➜ Never connect the shielding with the signal ground GND (TxD/RxD GND).

Customer-specific configuration

The interface is configured customer-specifically on the basis of the following parameters. The basic factory settings, in as far as not agreed otherwise, are highlighted:

Baud rate:	1200, 2400, 4800, **9600** or 19200 bauds
Parity:	even, odd, **none**
Stop bit:	**1**, 2
Data bits:	7, **8**

Note
In the case of data transfer without handshake lines do not connect Contacts 7 (RTS) and 8 (CTS).

1.5.2 Interface connection

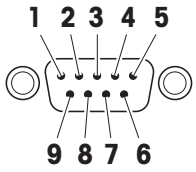
Self-made cables have to fulfill the following specifications:

- Shielded
- Twisted paired
- Cable resistance <125 Ohm/km
- Line cross-section >0.14 mm^2
- Cable capacity <130 nF/km

COM, COM1, COM2: D-Sub, 9-pin (male). Suitable counterpart: D-Sub 9-pin (female).

RS232C with handshaking lines

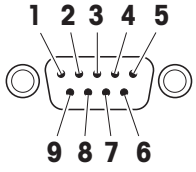
Note
In the case of data transfer without handshake, do not use Contacts 7 (RTS) and 8 (CTS) in the connector.



1	Free	5	Ground / GND
2	RxD, receive line of the checkweigher	6	Free
3	TxD, transmit line of the checkweigher	7	RTS
4	Free	8	CTS
		9	Free

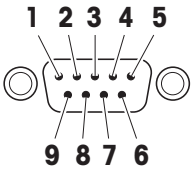
CL20 interface (line current 20 mA)

D-Sub, 9-pin (male). Suitable counterpart: D-Sub 9-pin (female)



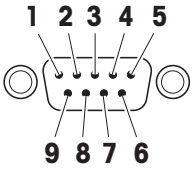
1	RxD+	6	Free
2	RxD–	7	Free
3	Free	8	Free
4	TxD+	9	Free
5	TxD–		

RS-422-A interface D-Sub, 9-pin (male). Suitable counterpart: D-Sub 9-pin (female)



1	TxD–	6	Free
2	Free	7	RxD+
3	TxD+	8	Free
4	Free	9	Free
5	RxD–		

RS-485 interface D-Sub, 9-pin (male). Suitable counterpart: D-Sub 9-pin (female)



1	Data–	6	Free
2	Free	7	Free
3	Data+	8	Free
4	Free	9	Free
5	Free		

2 Selection of the data formats

2.1 Serial interface

Note
The length of the package name amounts to at least 10 characters. Shorter package names are filled with blanks up to 10 characters. However, depending on the customization the length of the package name can amount to up to 20 characters.

2.1.1 Formats of the data output of weight data

Depending on the format (Formats No. 1 – 8) selected in the interface configuration, the character string is structured as follows:

Note
In special cases deviating customized formats are also possible.

Format 1: (STX)...(ETX) with package name

The character string consists of at least 22 characters.

Start	Article name	Weight	Unit	End
(STX)	XXXXXXXXXX	XXXXXXX	XXX	(ETX)

Field	Description
Start (STX)	1 character: (hex)02
Article name	10 characters, left justified
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (ETX)	1 character, (hex)03

Example: (STX)COFFEE¬¬¬¬¬500.00g¬¬(ETX)

Format 2: (STX)...(ETX) without package name

The character string consists of 12 characters.

Start	Weight	Unit	End
(STX)	XXXXXXX	XXX	(ETX)

Field	Description
Start (STX)	1 character: (hex)02
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (ETX)	1 character, (hex)03

Example: (STX)¬¬0.512kg¬(ETX)

Format 3: (CR)(LF) with package name

The character string consists of at least 22 characters.

Article name	Weight	Unit	End
XXXXXXXXXX	XXXXXXX	XXX	(CR)(LF)

Field	Description
Article name	10 characters, left justified
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (CR)(LF)	2 characters, (hex)_0D, 0A

Example: COFFEE¬¬¬¬¬¬¬¬1.2g¬¬(CR)(LF)

Format 4: (CR)(LF) without package name

The character string consists of 12 characters.

Weight	Unit	End
XXXXXXX	XXX	(CR)(LF)

Field	Description
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (CR)(LF)	2 characters, (hex)_0D, 0A

Example: ¬¬¬¬¬50g¬¬(CR)(LF)

Note

The output formats 5 to 8 contain the weight zone. The zone is identified as follows:

OK "Accepted" zone (meaning "good" products)

– First (inner) underweight zone

\+ First (inner) overweight zone

– – At 5 zones: Second (outer) underweight zone

++ At 5 zones: Second (outer) overweight zone

Format 5: (STX)...(ETX) with package name and classification

The character string consists of at least 24 characters.

Start	Article name	Weight	Unit	Zone	End
(STX)	XXXXXXXXXX	XXXXXXX	XXX	XX	(ETX)

Field	Description
Start (STX)	1 character: (hex)02
Article name	10 characters, left justified
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
Zone	2 characters, right justified and with leading spaces (OK, –, +, – –, ++)
End (ETX)	1 character, (hex)03

Example: (STX)COFFEE¬¬¬¬¬500.00g¬¬OK(ETX)

Format 6: (STX)...(ETX) without package name, with classification

The character string consists of 14 characters.

Start	Weight	Unit	Zone	End
(STX)	XXXXXXX	XXX	XX	(ETX)

Field	Description
Start (STX)	1 character: (hex)02
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
Zone	2 characters, right justified and with leading spaces (OK, –, +, – –, ++)
End (ETX)	1 character, (hex)03

Example: (STX)¬¬0.512g¬¬¬+(ETX)

Format 7: (CR)(LF) with package name and classification

The character string consists of at least 24 characters.

Article name	Weight	Unit	Zone	End
XXXXXXXXXX	XXXXXXX	XXX	XX	(CR)(LF)

Field	Description
Article name	10 characters, left justified
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
Zone	2 characters, right justified and with leading spaces (OK, –, +, – –, ++)
End (CR)(LF)	2 characters, (hex)_0D, 0A

Example: COFFEE¬¬¬¬¬¬¬¬1.2g¬¬– –(CR)(LF)

Format 8: (CR)(LF) without package name, with classification

The character string consists of 14 characters.

Weight	Unit	Zone	End
XXXXXXX	XXX	XX	(CR)(LF)

Field	Description
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
Zone	2 characters, right justified and with leading spaces (OK, –, +, – –, ++)
End (CR)(LF)	2 characters, (hex)_0D, 0A

Example: ¬¬¬¬¬50g¬¬¬+(CR)(LF)

2.1.2 Formats of the data output at multiple-line operation (option)

If the checkweigher is designed as a multiple-line weighing system, the number of the line (1, 2, ...) is included in the character string. This ensures that the weight values are allocated clearly to the respective production line from which it originates. The character string becomes 1 character longer.

This "special length" can – if necessary – only be changed by the after sales-service.

Format 1: (STX)...(ETX) with line number and package name

The character string consists of at least 23 characters.

Start	Line	Article name	Weight	Unit	End
(STX)	X	XXXXXXXXXX	XXXXXXX	XXX	(ETX)

Field	Description
Start (STX)	1 character: (hex)02
Line	"Line number" (1 character)
Article name	10 characters, left justified
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (ETX)	1 character, (hex)03

Example: (STX)2COFFEE¬¬¬¬¬500.00g¬¬(ETX)

Format 2: (STX)...(ETX) with line number, without package name

The character string consists of 13 characters.

Start	Line	Weight	Unit	End
(STX)	X	XXXXXXX	XXX	(ETX)

Field	Description
Start (STX)	1 character: (hex)02
Line	"Line number" (1 character)
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (ETX)	1 character, (hex)03

Example: (STX)2¬¬0.512kg¬(ETX)

Format 3: (CR)(LF) with line number and package name

The character string consists of at least 23 characters.

Line	Article name	Weight	Unit	End
X	XXXXXXXXXX	XXXXXXX	XXX	(CR)(LF)

Field	Description
Line	"Line number" (1 character)
Article name	10 characters, left justified
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (CR)(LF)	2 characters, (hex)_0D, 0A

Example: 2COFFEE¬¬¬¬¬¬¬¬1.2g¬¬(CR)(LF)

Format 4: (CR)(LF) with line number, without package name

The character string consists of 13 characters.

Line	Weight	Unit	End
X	XXXXXXX	XXX	(CR)(LF)

Field	Description
Line	"Line number" (1 character)
Weight	7 characters, number of subsequent decimal places depending on the configuration (0, 1, 2 or 3), no decimal point if there are no decimal places behind it, right justified and with leading spaces
Unit	3 characters, left justified (g/kg/oz/lb)
End (CR)(LF)	2 characters, (hex)_0D, 0A

Example: 2¬¬¬¬¬50g¬¬(CR)(LF)

2.2 Data communication via the Ethernet interface

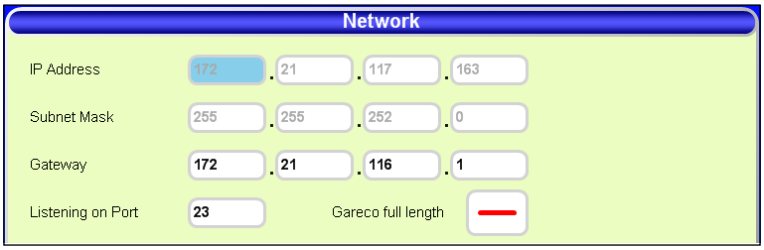
The Ethernet connection provides several possibilities for sending data to the checkweigher or for calling them from the checkweigher via the Intranet.

There are some predefined applications that use the Ethernet connection. ProdX, Freeweigh.Net, Garvens LoginServer and Garvens ReAcT have to be mentioned first here. To set this up, certain parameters only need to be entered on the checkweigher once. For situations where the data delivered needs further processing, for example, weight data or GARECO.Net you need to understand how transmitting data via Ethernet and TCP/IP works in principle.

2.3 Checkweigher configuration

2.3.1 Basic settings

In order to set the checkweigher up as a participant on the network, the unique network parameters need to be entered. These values should always be supplied by the network administrator. The data in the following figure are only an example!



Network services are only available if the options GARECO or "Weight data via Ethernet" are active.

Once the TCP server has been started, it waits for connection requests from TCP clients via the port that has been entered for "Listening on Port:". Any value can be assigned. Note, however, that all values smaller than 1023 may conflict with default network services. The value 23 is pre-set and safe since the default service "Telnet" is based on this port number.

Note
After changing the values for "IP address", "Subnet Mask" and "Listening on Port", you need to restart the checkweigher!



CAUTION

A wait of at least 10 seconds after turning the machine off is required before turning the machine back on, otherwise the electronics may be damaged.

➜ After turning the checkweigher off, wait at least 10 seconds before turning it back on.

You can try out the options "Weight data" and "GARECO" by using the Telnet utility without having to write your own programs.

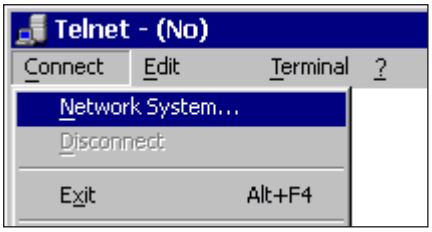
2.4 Testing Ethernet using Telnet

Put simply, Telnet is a text window or a test-oriented program with which another computer (host) in the network can be controlled remotely by the user. All the modern operating systems nowadays dispose of a Telnet client program. The Telnet client establishes a TCP connection to a Telnet server, receives keyboard entries from the user, passes them on to the Telnet server and displays the characters sent by the server on the screen.

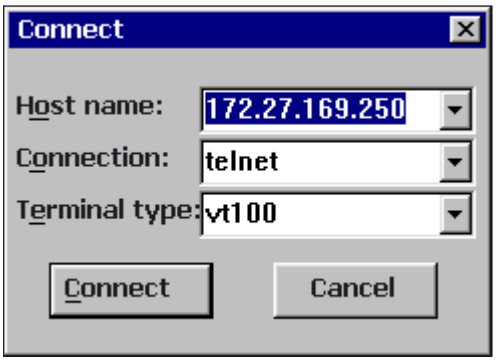
The following description applies for the Windows XP operating system.

Note
If Telnet is not available directly on your Windows computer, have it installed by your system administrator.

Start Telnet (on MS Windows XP usually under: C:\WINDOWS\TELNET.EXE) and select the menu item "Network system".



You now need the checkweigher IP address. Enter the address in the "Host name" field in the Telnet connection dialog. Since the Telnet program uses an international standardized connection port, you need only enter the value 23 into the "Connect on Port" field on the checkweigher.



The **Connect** action now attempts to establish a connection with the checkweigher over the network. If this is successful, the checkweigher displays the message "Accept: xxx . xxx . xxx . xxx" with the specification of the IP address of the PC. In addition Telnet opens an input window in which you can enter the strings. Telnet transfers every entered character immediately to the server (the checkweigher). It is not possible to correct any typing errors. Use the Telnet help function in order, for example, to set the local echo. You are now ready to start transmitting weigher data.

2.5 Receiving weight data via TCP

Course

1. Establish a connection.
2. Set protocol type, if it is different from the default setting.
3. Set protocol format, if it is different from the default setting.
4. Start transmission.
5. Stop transmission.
6. Test connection.

(SPACE) = Space, ASCII HEX 20h

(CR)(LF) = Carriage Return, Line Feed (ASCII HEX 0Dh 0Ah); for Telnet: "Enter" key

Establishing the connection

1. Establish a connection.

See the previous chapter.

Setting the protocol type

The protocol type defines which weight value from the checkweigher should be transmitted. There are 4 protocol types to choose from.

Note
You only need to set the protocol type if it deviates from the default setting X=2!

2. Transmit the string "**WD_SET_PROT**(SPACE)**X**(CR)(LF)", where X is a value from the following list:

X	**Protocol type**
2	Transmission of the current weight value (**default**)
3	Transmission of the current weight value, but only for accepted (non-rejected) products
4	Transmission of a mean value after every weighing. The weight that is also displayed in the left-hand gauge of the basic screen is transmitted.
5	Transmission of the mean value across the last n products, whereby n can be entered at the checkweigher. A transmission only takes place every n products.

Setting the protocol format

There are also 4 protocol formats to choose from. After setting the "what", now set the "how" of the transmission. The protocol format determines the string pattern used to transmit the weight data.

Note

You only need to set the protocol format if it deviates from the default setting X=4!

3. Transmit the string "**WD_SET_FORMA**T(SPACE)**X**(CR)(LF)", where X is a value from the following list:

X	Protocol format	Total characters
1	(STX); 10-char article name; 7-char weight; 3-char unit; (ETX)	Min. 22
2	(STX); 7-char weight; 3-char unit; (ETX)	12
3	10-char article name; 7-char weight; 3-char unit; (CR)(LF)	Min. 22
4	7-char weight; 3-char unit; (CR)(LF) (**default**)	12

Starting the transmission

4. Transmit the character sequence **WD_START**(CR)(LF)".

   For every subsequent product, the transmission is immediately performed based on the set type and format.

Stopping the transmission

5. Transmit the character sequence "**WD_STOP**(CR)(LF)".

   The transmission is stopped.

Testing the connection

One characteristic of a TCP connection between the TCP server and the TCP client is that the client cannot automatically determine whether the server may have terminated the connection. For this reason, the client can test whether the connection still exists.

6. Transmit the character sequence "**WD_TEST**(CR)(LF)".

   If a connection exists, the checkweigher immediately transmits "**WD_OK**(CR)(LF)" back.

Sending weight data immediately

In this case transmitting of weight data begins without a start command immediately after the TCP/IP connection has been established. Format and content are specified on a configuration page in the checkweigher.

2.6 GARECO via TCP

1. Establish a TCP connection to the TCP Server of the checkweigher, for example via Telnet as described in the beginning.

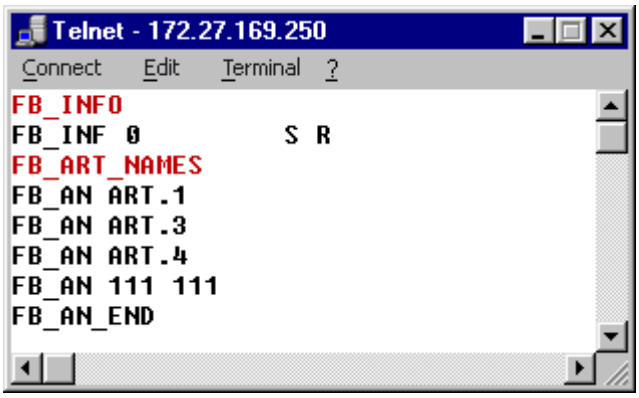
   The TCP Server for GARECO is non active and analyzes all the incoming characters.

2. Now send the GARECO commands to the checkweigher.

   You receive the response immediately via the same connection.

   If, for example you send FB_INFO(CR)(LF) you receive the response FB_INF xxx (CR) (LF) in the Telnet window.

Information about further commands is available in the GARECO instructions.



2.7 OPC Server (option)

The optional OPC Server allows communication between an X-Series checkweigher and other automation system under application of the OPC-DA specification 2.05A. The OPC Server is designed for data communication networks that have interfaces to SCADA/HDI control computers.

The checkweigher always operates an an OPC Server. This ensures that some data of the checkweigher are visible for an OPC Client and can be processed further in the OPC systems.

Note
Gareco.NET, FreeWeigh.NET or other interface protocols cannot be used via OPC.

Two checkweighers cannot communicate directly with each other via OPC. A separate OPC Client is required for direct communication.

2.8 Fieldbus system (option)

The fieldbus interface (FIM) is an option for communication between a checkweigher of the X-Series and other automation systems under utilization of one of the following automation fieldbuses:

- PROFIBUS
- Ethernet/IP
- DeviceNet
- ControlNet
- Modbus/TCP

The following information can be transferred:

- Individual weights
- Production reports
- Package changeover
- Line integration
- "Checkweigher ready"
- "Checkweigher running"
- Emergency-stop
- Emergency run
- Conveyor start/stop commands.

Further possibilities of each interface are described in the respective separate interface manual.

Note
Gareco.NET, FreeWeigh.NET or other interface protocols cannot be used via fieldbus.

Two checkweighers cannot communicate directly with each other via fieldbus, but only via a separate fieldbus master.

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