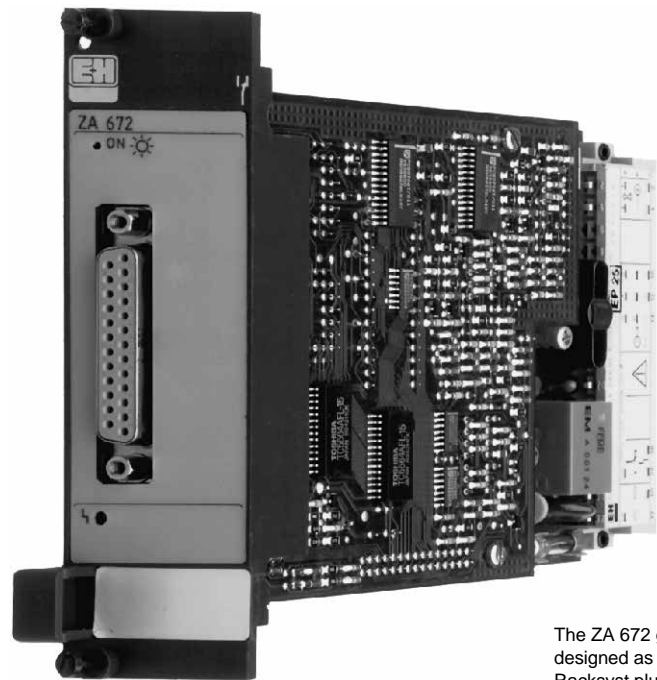# Field Communication
modbus gateway ZA 672

With command and data ports for digital control of intrinsically safe field instrumentation

The ZA 672 gateway is designed as a 19" Racksyst plug-in module

Application

The ZA 672 modbus gateway interfaces intrinsically safe Commutec measuring points to programmable logic controllers, process control systems and personal computer. It has three major features:

- an auto-scan buffer listing preselected process parameters,
- an RS-232C command port accessing the buffer and each Commutec transmitter,
- a data port with the Modbus protocol accessing the buffer and each Commutec transmitter.

The scan, data port and command port functions operate independent of each other, ensuring efficient processing and optimal data transfer rates.

Features and Benefits

- Modbus defacto standard
The ZA 672 gateway conforms to the Gould/Modicon Modbus Protocol, see Reference Guide PI-MBUS-300 REV B.

- Link to field instrumentation
Level, pressure, temperature and flow data from intrinsically safe measuring points can now be acquired by Modbus systems.

- Auto-scan buffer
Provides not only accelerated access to process data but also saves memory and time in the supervisory system.

- RS-232C command port
In addition to data access, this port can be used to up- and download Commutec operating parameters and to visualize measured values.
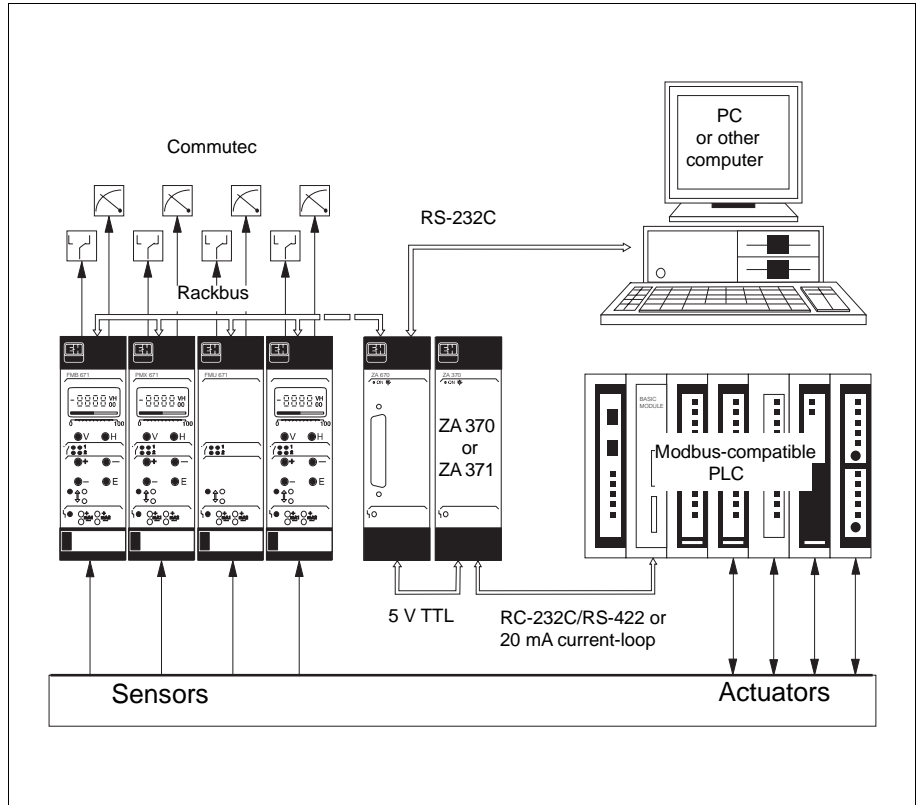
Endress+Hauser
The Power of Know How

Measuring System

The measuring system comprises
- up to 64 Commutec transmitters or 128 measuring points
- ZA 672 modbus gateway
- Personal Computer at the command port
- Modbus-compatible programmable logic controller at the data port.
- ZA 370 interface for 5V TTL/RS-232C/RS-422 or ZA 371 interface for 5V TTL/20 mA current loop conversion.

Commutec Transmitters

Commutec transmitters are intelligent 19"-rack modules designed for the control of Endress+Hauser sensors. They are available for:
- level measurement (capacitive, conductance, ultrasonic, hydrostatic)
- pressure measurement,
- flow and temperature measurement.

Commutecs provide intrinsically safe power for sensors operating in explosion hazardous areas. The signals sent back from the measuring point are conditioned as:
- a measured value display, at the transmitter or a Commulog handheld terminal
- a 0/4…20 mA analogue signal
- a 0/2…10 V signal
- a limit value controlled relay output.
- a digital signal passed to the Rackbus.

Rackbus

Up to 64 Commutec transmitters can be connected together on the Rackbus system. Using a simple two wire technique, data is passed along the bus at a rate of 19.2 kbits/s. Each transmitter has a unique device address which allows it to be polled by the ZA 672 interface.

ZA 672 Modbus Gateway

The ZA 672 modbus gateway is compatible with existing Rackbus equipment. Commutec operating programs and data links used with the ZA 670 computer interface can be run via the RS-232C command port. Exceptions are those requiring protocol mode or TTY link. The data port is interfaced to the Modbus via a ZA 370 or ZA 371 module.

The Commutec transmitter is set for ZA 672 operation at the hook switch, a unique address is configured at the DIP-switches.
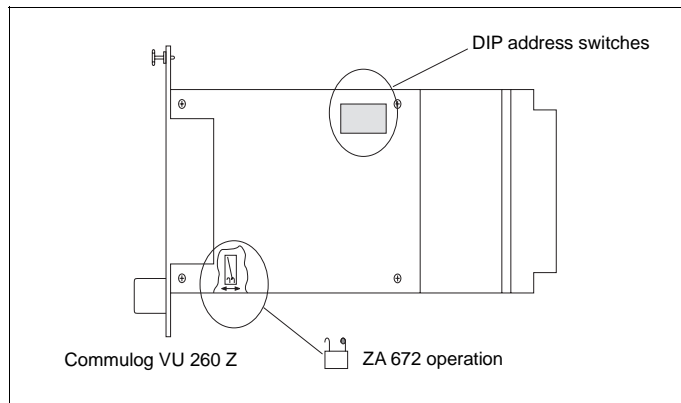
ZA 672 Gateway

Interface Ports
The ZA 672 gateway offers the user two serial ports for the connection of personal computers, programmable logic controllers and process control systems:

- the command port for connecting RS-232C compatible systems.
- the data port for connection of Modbus systems via an RS-232C, RS-422 or 20 mA current-loop interface.

Both can be used simultaneously to directly access Commutec operating matrices or read values from the auto-scan buffer.

Device Polling
The Commutec transmitters are polled according to a freely configurable scan list which is accessible from both command and data ports. The poll runs automatically: when the last Commutec has been polled, the scan begins again. The resulting data are written into the auto-scan buffer.

Auto-Scan Buffer
The primary function of the ZA 672 gateway is the maintenance of the auto-scan data buffer. In this memory block every Commutec measuring point in the scan list is allocated a data field containing the following information:

- measured value
- measuring point status
- event
- communications status

Measured values are e.g. levels, flow rates, pressures. Events are flags indicating limit value status. The measuring point and communications status indicate the operational status of the Commutec-sensor and Commutec-ZA 672 links respectively.

Measured Value Acquisition
The system acquires measured values from the auto-scan buffer either as individual values or in the form of block telegrams. Only those registers specified in the telegram are read, allowing priorities to be set by the frequency of polling.

Commutec Configuration
The command port (and data port) can also be used to transmit instructions, directly to the operating matrix. If polling occurs simultaneously the ZA 672 regulates access between the scan and configuration functions.

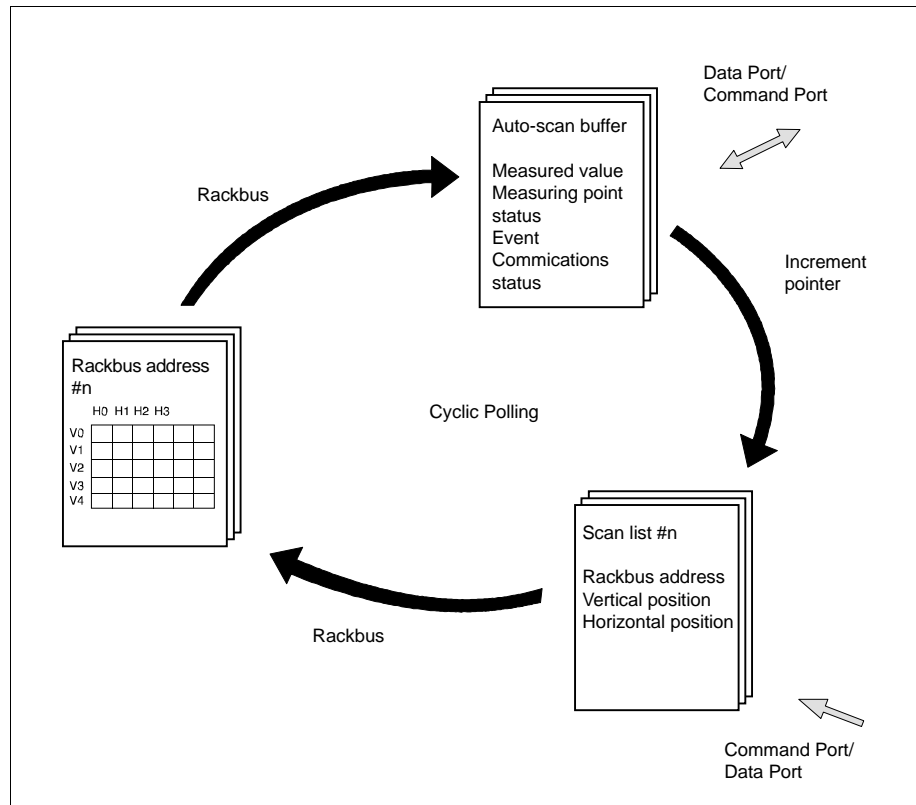Block diagram of the ZA 672 gateway structure
- Direct access to Commutec transmitters is provided via the Rackbus
- Indirect access to process data via the scan buffer is quicker.
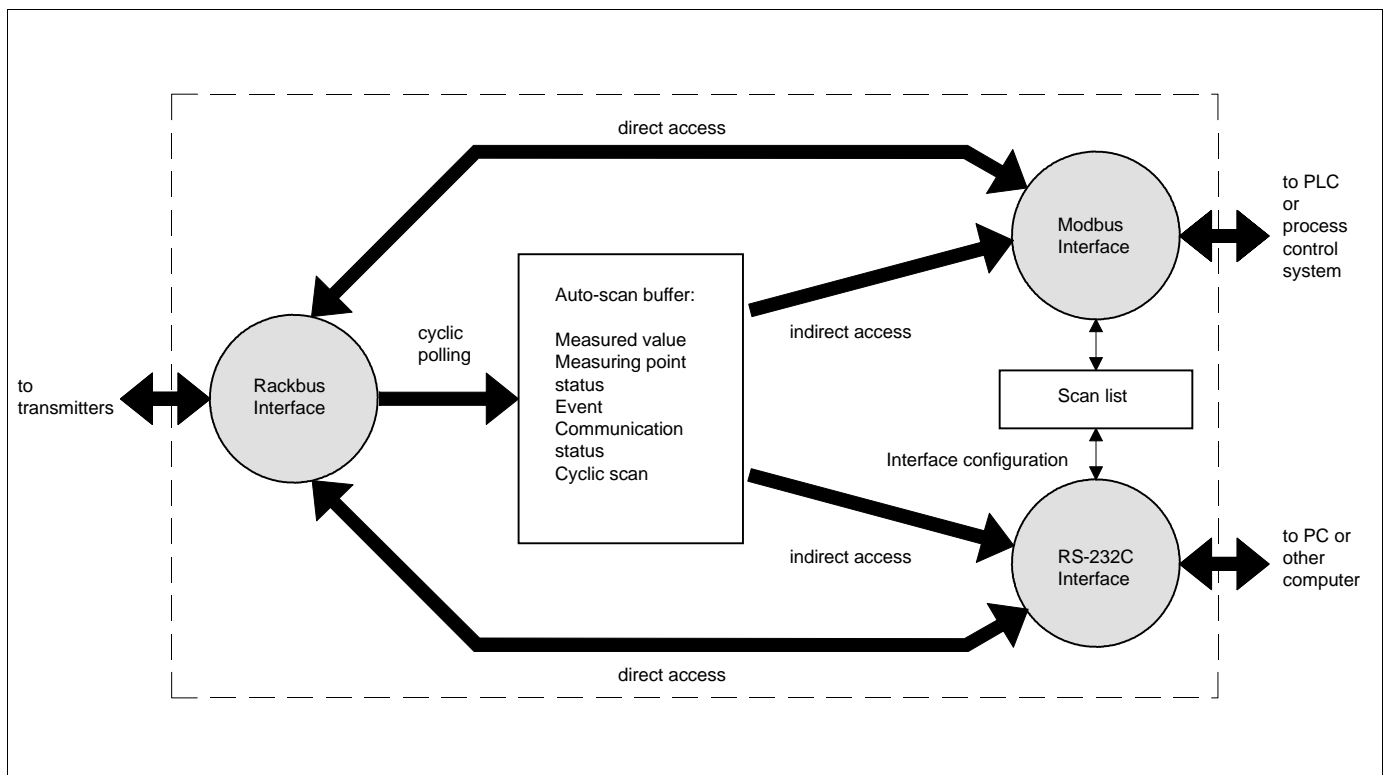
Command Port

Logical polling sequence for auto-scan buffer:
• The entries in the configuration file are cyclically scanned.
• The Commutec matrix is polled via the Rackbus
• The measured value, communication and event status are filed in the auto-scan buffer

[In the diagram:]

Data Port/ Command Port

Auto-scan buffer

Measured value
Measuring point status
Event
Commications status

Increment pointer

Rackbus

Cyclic Polling

Rackbus address #n

H0 H1 H2 H3
V0
V1
V2
V3
V4

Scan list #n

Rackbus address
Vertical position
Horizontal position

Rackbus

Command Port/ Data Port

RS-232C Command Port

The command port interfaces RS-232C devices to the ZA 672 gateway. It is freely configurable at the DIP-switches on the plug-in board. The port is used:

• to configure the Commutec operating matrices on commissioning,
• to secure Commutec configurations by up- or downloading data,
• to create and amend the scan list for the auto-scan buffer.
• to configure the Modbus data port

The port also has access to the auto-scan buffer.

Scan list

The scan list contains up to 320 indexed entries defining:

• Commutec rackbus address,
• vertical position of the measured value in the Commutec operating matrix,
• horizontal position in the matrix.

The file can be read and appended, fields inserted, overwritten and deleted by the commands LST, APP, INS, OVW and DEL, e.g.

    INS 40, 36, 0, 0

inserts the Commutec with address 36 at position 40 in the list: the principle measured value at V0H0 is read.

Variable Read Command

The variable read command allows direct access via the Rackbus to the Commutec operating matrix. The Rackbus address, vertical and horizontal matrix position must be defined:

    VR 36, 0, 0
    36, 245.7

The ZA 672 responds with the Rackbus address and a data string. If an error is detected, an error code is sent back.

Variable Write Command

The variable write command allows a value to be written into the specified position in Commutec matrix. Rackbus address, matrix positions and number or value must be defined.

    VW 36, 1, 0, 10.0
    36,10.00

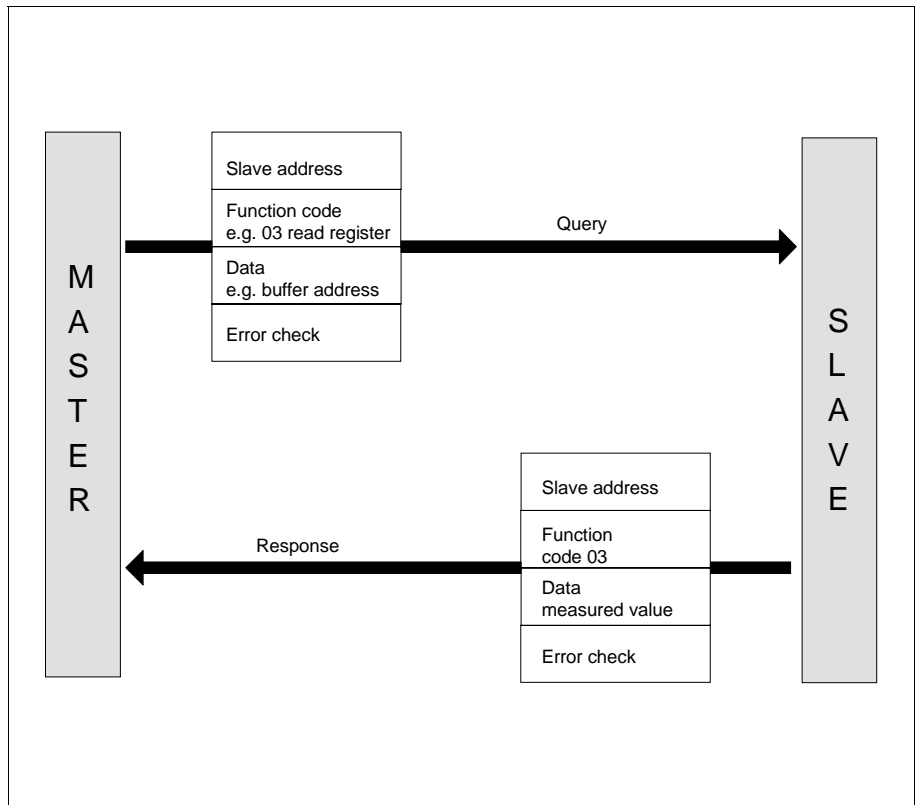The ZA 672 replies with the Rackbus address and ASCII string actually stored.

Auto-Scan Buffer Command

For fast access to Commutec data the Auto-scan buffer can be polled.

    VRB 10
    010, +00314E-01, 002, 606

The ZA 672 replies with list position, Rackbus address, measured value and event and status data in a fixed format.

Data Port

Block diagram of a Modbus query/response transaction

Modbus Data Port

The ZA 672 data port interfaces to Modbus devices. The Modbus protocol controls the language structure and message format. It provides for one master and up to 247 slaves, whereby the permissible number of slaves may be less.

Master/Slave operation

Since not all PLC systems can be configured as masters, the ZA 672 can assume the additional role of master. This function and other variables such as baudrate, parity, stopbits and transmission mode can be set from the command port.

- When the ZA 672 is operating as a master the contents of the auto-scan buffer are continually transmitted to the slave at preset intervals. No other data can be accessed.
- Priorities can be allotted by multiple entries in the scan list.

Modbus Transactions

The Modbus protocol controls the query and response cycle between master and slave. The ZA 672 supports the following functions:

- Query/response transaction comprising a single query and single response frame,
- Function codes 03, 06, 08 and 16

Frames

The Modbus protocol provides frames for the transfer of data on the data line. These contain the data:

- slave address
- function code
- data (e.g. buffer address, length, measured value)
- error check.

When the slave receives the message, it checks for errors, reads the contents and builds the response for transmission back to the master. The master sends the next message as soon as it receives a valid response, or if no reply is received, when the timeout is exceeded.

Transmission Modes

Data can be exchanged in two transmission modes:

- ASCII, readable, used e.g. for testing
- RTU, compact and faster, used for normal operation.

Transmission Medium

The Modbus protocol does not specify the transmission medium (Layer 1, ISO-OSI model). The following options are available:

- RS-232C via the ZA 370 interface,
- RS-442 via the ZA 370 interface,
- TTY 20 mA current loop via the ZA 371 interface

Installation

Wiring diagram for backplane connector.
• The command terminal is plugged into the front panel or can be connected at the rear.
• The ZA 370 or ZA 371 module is connected to pins z2, z4, d4 on the backplane connector.
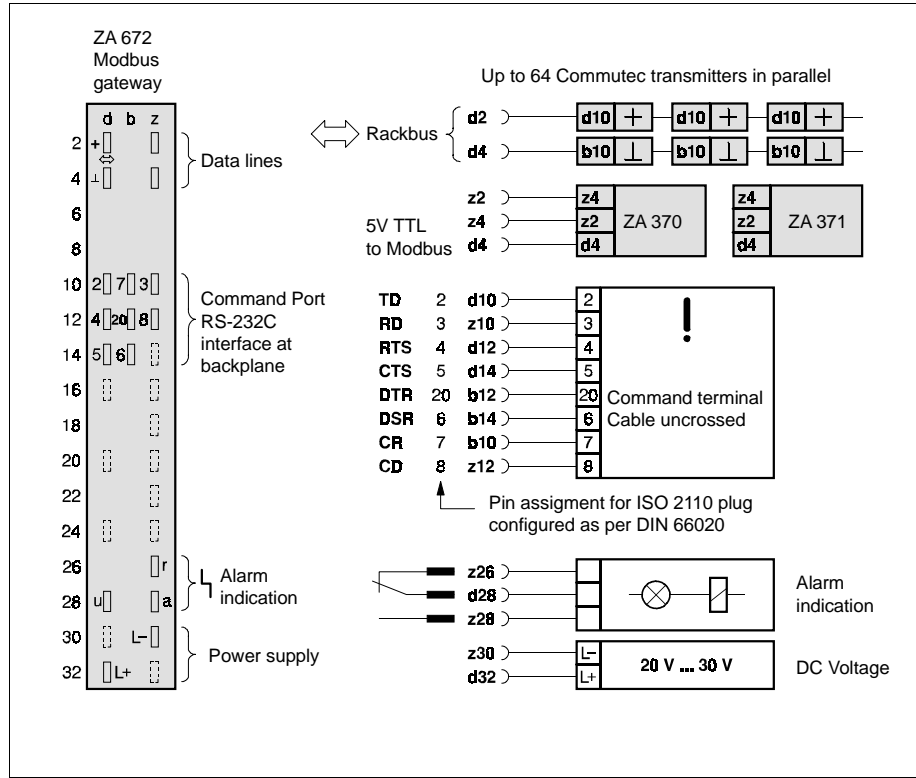
ZA 672 Connection
The diagram above shows the wiring of the ZA 672 Modbus Gateway

• The command port is on the front panel and is configured at the DIP-switches.
• The Modbus data port is configured via the command port.
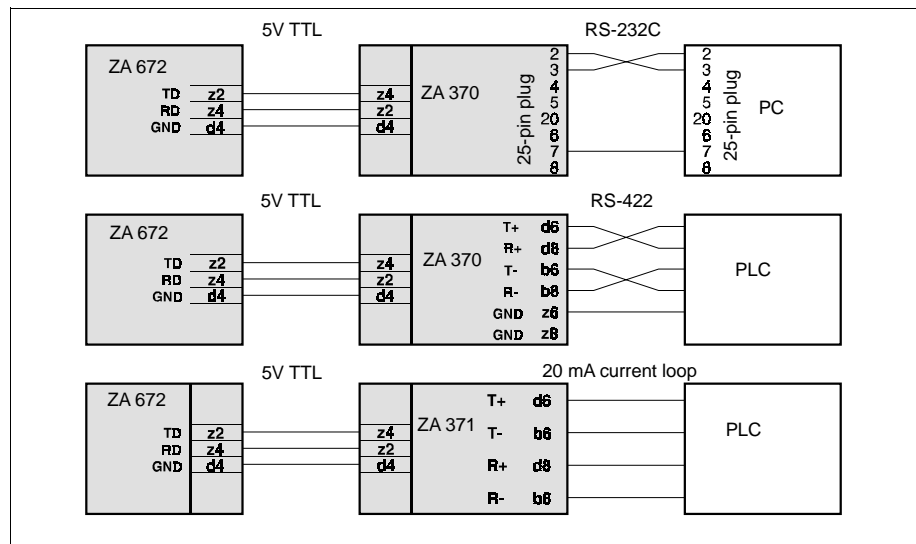
ZA 370/371-Modbus Connection
The diagram below indicates the connection of the ZA 672 and Modbus via the ZA 370 and ZA 371 modules.

• RS-232C max. 15 m/50 ft
• RS-422 max. 1200 m/4000 ft
• TTY 20 mA current loop max. 1000 m/ 3300 ft.
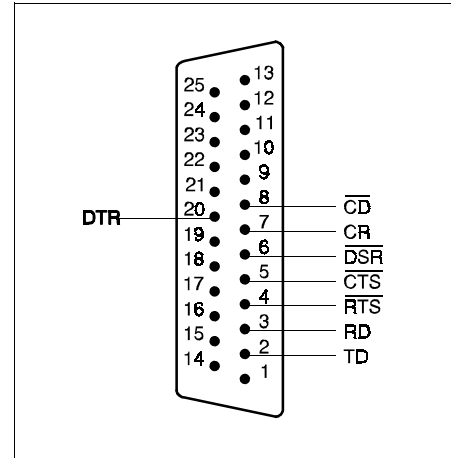
Pin assignment of command port

Wiring diagram for ZA 672, ZA 370 and ZA 371 modules

Technical Data

Mounting

The Modbus Gateway ZA 672 is a Racksyst plug-in card which must be installed outside explosion hazardous areas in a rack or protective housing, for example:

- 19" rack for mounting up to 12 x 7 HP modules in the control room,
- Half 19" wide field housing with Protection IP 65,
- Monorack housing (7 HP) for single or multiple mounting at the measuring point.
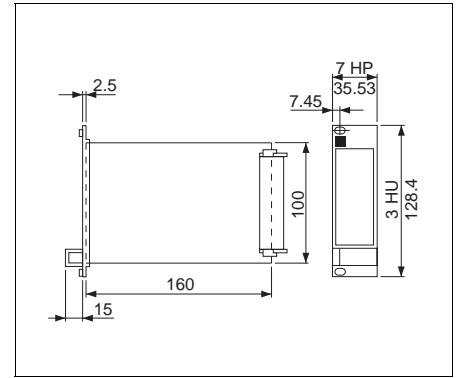
Card dimensions (mm)

Construction

Plug-in card to DIN 41 494 (Eurocard).

- Frontpanel: black synthetic with blue field inlay, grip and tag space
- Degree of Protection to DIN 40 050: panel IP 20; board IP 00
- Dimensions: see diagram
- Weight: approx. 0.3 kg
- Permissible ambient temperature:
  Operation: 0 °C…+70 °C
  Storage: −20 °C…+80 °C

Electrical Connection

- Backplane connector:
  multipoint plug to DIN 41 612, Part 3, Type F (28-pole)
- Front panel connector:
  25-pin female connector conforming to ISO 2110 socket, configurable as per DIN 66 020 as DTE or DCE

Power Supply

Electrically isolated power supply:
- Voltage: 24 VDC (+6 V…−4 VDC)
- Residual ripple: max 1 V within tolerance
- Current: approx. 90 mA, max. 120 mA, integrated fine-wire fuses (315 mA)
- Status: green LED lights when on.

Fault Indication

Relay with potential-free changeover contact:
- Max. switching capacity:
  - 2.5 A, 250 V AC, 300 VA at cos φ>0.7
  - 100 VDC, 90 W
- Status: red LED lights on alarm

Transmission Medium

- Data port for connection to Modbus devices via:
  - RS-232C interface (ZA 370)
  - RS-422 interface (ZA 371)
  - TTY 20 mA currect loop (ZA 371)
- Command port for connection of RS-232C devices.

System requirements

- Modbus functions 03, 06, 08 and 16 must be supported
- Floating point numbers as sign, integer and exponent (please check with us)

Rackbus interface

- Devices: max. 64 Commutec transmitters
- Baudrate: 19.2 kbits/s

Command Port

Configurable by DIP-switches on the ZA 672 board:
- Baudrate: 300…19,200; recommended: 9600 Baud.
- Data bits: 7 or 8
- Stop bits: 1 or 2
- Parity: None, even or odd.

Memory response time:
- Direct Rackbus access: 250 ms/value
- Via auto-scan buffer: ca. 50 ms/value set

Data Port

Modbus protocol, software-configurable via the command port:
- Transmission mode: RTU or ASCII
- Modbus function: slave or master

Data transmission format configurable:
- Data bits: 7 or 8
- Parity: None, (N) even (E) or odd. (O)
- Stop bits: 1 or 2
- Baudrate: 600…19,200;
Supported combinations:
- ASCII: 7N2, 7E1, 7O1, 9600
- RTU: 8N1, 8E1, 8O1, 9600

Memory response time:
- Direct Rackbus access: 250 ms/value
- Via auto-scan buffer: ca. 50 ms/value set

How to Order

Modbus Compatible Systems

- ABB MP 200/1 with DSCA 180B
  AEG A 500, A 350,
  AEG-Modicon   984-120, 130, 145,
                984- 380, 480, 680,
                984A, B, X
  Allen-Bradley
  Bernecker+Reiner
  CEGELEC P 1200
  Fisher Controls Provox
  Foxboro

- H+B Contronic P
  Hima H30, H50, H51
  Honeywell TDC 3000
  Merlin Gerin PB 400
  Siemens S5 (driver software available)
  Syclop de Meci
  Téléméchanique TSX 67/20
  Valmet Damatic XD
  VDO MDC 200
  and others

Supplementary Documentation

Modbus Protocol
- ☐ Gould Modbus Protocol:
  Reference Guide PI-MBUS-300
  (Gould Electronics)

Racksyst
- ☐ Racksyst
  System Information SI 008F/00/e
- ☐ Assembly Racks FXG 1
  Technical Information TI 224F/00/e
- ☐ Monorack
  Technical Information TI 187F/00/e

Rackbus
- ☐ Rackbus
  System Information SI 014/00/e

- ☐ Integration of intrinsically safe field
  instrumentation into industrial networks
  Special Documentation SD 014/00/e

Commutec Transmitters
- ☐ Commutec Transmitters
  System Information SI 012/00/e
- ☐ Omnigrad TMT 2371…2377
  Technical Information TI 022/02/ei
- ☐ Procom II
  In Preparation

Commutec Software
- ☐ Commutec Operating Program for
  Personal Computers
  Technical Information TI 113/00/e
- ☐ Commugraph
  Technical Information TI 158/00/e