

Specification for '2 wire' electric valve actuator remote control system.

GENERAL

The data monitoring and control system shall consist of a master station and field units. The master station shall perform the tasks of bus master, data collector, data concentrator, operator interface, protocol converter and be a slave to a host system.

The system shall be capable of operating with up to 60, 120, 180 or 240 field units on a 2 wire screened twisted pair data highway of length up to 20 kilometres (12.5 miles) without repeaters or other additional devices. The cable shall be connected from the master station to each field unit in turn and back to the master station.

The master station shall provide serial data communication with a host system such as a Distributed Control System, PLC, RTU or computer via data ports using either Modbus RTU or Modbus TCP protocol.

The master station and field units shall be protected against lightning by the provision of transient suppressor devices on all 2 wire connection ports rated at 1.5 kV for 1 millisecond. Opto-isolation shall be used within the field units and master station for enhanced noise protection.

MASTER STATION

The master station shall be of microprocessor type, suitable either for panel or 19" rack mounting. All signals from the master station to the field units shall be suitable for transmission over a 2 wire twisted pair cable with overall screen and shall use a current loop serial data communication. This cable shall be connected from the master station to each field unit in turn and then back to the master station.

It shall be suitable for the following operational conditions:

- Operating temperature: -10 to 50 °C.
- Storage temperature: -10 to 70 °C.
- Relative Humidity: 5% to 95% non-condensing.
- Power: 85-265 Vac, 47~63 Hz,
18-36 Vdc

The master station shall include a graphical colour LCD display panel and operator control keypad to allow it to be used as an operator interface. Navigation between screens shall use icons backed with a text description. The display panel shall be capable of showing the status and Tag number of every connected field unit, actuator or other device associated with the field unit, the status of the master station, the system settings, the host protocol messages, the loop performance, any alarms present on the system and the status of any hot standby partner.

The keypad shall permit viewing and modification of all of the master station system data. It shall also allow the connected actuators or other devices to be monitored and operated. The parameters set in each field unit shall be visible and there shall be a mechanism for altering field unit settings (except address) either from the master station directly or via the host communications ports. The facility to test system performance and adjust the field communication speed shall be provided. It shall be possible to set the highest address number of connected field units to minimise scanning times.

A PIN security system shall be included to prevent access to control and setting of parameters via the master station LCD and keypad. Control shall be able to be interlocked by inhibiting actuator commands from any host port. Direct access to the master station web pages via any of the Ethernet host communications ports shall be protected by a user name and password. The ability to allow only limited host IP addresses to access the master station via ModbusTCP will also be provided.

A real time clock shall be included for alarm event time/date marking and it shall be possible to synchronise this clock via an NTP (Network Time Protocol) server.

It shall be possible to capture and display on the LCD screen the last 5 messages sent to the master station and the replies from the master station, via the host communications ports. It shall be possible to view the loop status including a map of the connected field devices and their communications status.

Host Communications

Host system communication shall be by RS232, RS485 or Ethernet. The host protocol shall be Modbus or Modbus TCP to minimise custom software and programming. There will be 4 host ports available, 2 serial ports, selectable as either RS232 or RS485 and 2 Ethernet ports. The Baud rate for serial communications shall be adjustable from 2400 to 115200 with odd, even, always zero or no parity. There will be provision for an additional third Ethernet port (Service port) to be used for configuration and temporary connections. The Ethernet communications baud rate shall be 100MB or 10MB on all three ports.

The Ethernet ports will include a web server connection and embedded web pages and shall provide the ability to parameterise, control and monitor the connected actuators. The Ethernet port shall support up to 10 simultaneous users.

All communications ports shall be independent to ensure correct alarm handling to each of the connected hosts, or for use in redundant host communications.

Redundant Systems - Hot Standby

When required the master station shall include a redundant 'hot standby' unit that will automatically assume control if the primary unit fails, this transfer of control shall be user transparent, bumpless and take less than 2 seconds. The status of the standby and primary units shall be available for review by the host system at all times. It shall be possible to change control from primary to standby unit either remotely (over the communication link) or locally by the keypad.

FIELD COMMUNICATIONS

The 2 wire loop shall use a 20 mA current for data transmission with a maximum applied voltage of 17V. The current shall be modulated to enable messages to be transmitted. Full CRC and message framing checks must be included in the data protocol.

The system shall continuously cyclically poll each connected field unit and report any changes in status of the field unit or communication failure. On receipt of a command from the master station keypad or the host system such as a PLC the command shall take precedence over the data collection, polling shall cease and the command shall be immediately transferred to the field unit. Provision shall be included to ensure the field unit has received the command correctly.

Failure or loss of power to any one or more connected field units on the 2 wire cable shall not cause loss of control or communication with the remaining devices connected to the cable. On restoration of power to a field unit it shall be located and communicated with automatically.

The system shall tolerate a single open, short or ground fault in the 2 wire cable without losing the ability to communicate and control any field unit remaining connected. An alarm shall be posted to indicate between which two field units the fault has occurred. Multiple faults shall result in the loss of communication with those field units which have become isolated and not the entire system. This cable security feature shall be inherent in the system and achieved using only a single cable without the need for duplicate or additional hardware.

Field Unit

Field units shall be plug in cards, or easily added to existing valve actuators. They shall also be available in a variety of enclosures suitable for location in the field or control room environment.

Parameter Settings

There shall be settings for the loop baud rate and unique address (up to 240) for each field unit. These settings shall be made non-intrusively without the need to remove covers or gain access directly to the field unit itself. Where general purpose field units are required it shall be possible to invert the reported input signal status.

Valve Actuator Field Units

When fitted to a suitable valve actuator the field unit shall require no additional power connection. The field unit shall form an integral part of the actuator assembly and it shall be an addition to the actuator control circuit and independent from that control circuit. It shall report the following signals to the master station:

Valve opening, Valve closing, Valve open, Valve closed, Valve stationary in mid position, Actuator fault, Field unit fault, Cable fault.

In addition it shall also report some or all of the following signals:

- Continuous valve position
- Monitor relay trip
- Thermostat trip
- Local Stop selected
- Local Control selected
- Valve Obstructed
- Valve Jammed
- Four additional remote digital input signals

Remote control functions shall be provided to permit the actuator to:

- Open fully
- Close fully
- Stop at any time
- Assume an intermediate position
- Assume Emergency Shut Down position

ESD shall be able to be set to cause the actuator to ESD Close, ESD Open, Stay Put. Receipt of an ESD signal shall override any existing, local or remote, open or close signal and shall override the motor thermostat. An additional hard-wired ESD facility shall still remain within the actuator control capability.

When forming an integral part of the actuator the field unit must be located in a separate compartment from the field terminals. This compartment shall be double 'O' ring sealed from the external environment. The whole enclosure shall be to IP68 (NEMA IV and NEMA VI). In hazardous area applications it shall be certified to a minimum of EExd IIB T4, or to the same certification as the actuator.

When control room located the field unit shall be 19 inch rack mounting and provided with a suitable 19 inch rack. All connections to the unit shall be to the front.

The actuator and field unit combination shall be suitable for an operating temperature range of -30°C to +70°C and +80°C storage.

General Purpose Field Unit

General Purpose field units shall be similar to actuator field units with the same isolation and protection capabilities. They shall be capable of reporting the status of 8 digital and 2 analogue (for example 4-20 mA) inputs.

The field unit shall be capable of providing 4 digital outputs, each configurable for fleeting or maintained status and 1 analogue (0-5V) output. All I/O shall have discrete address capability.

When field mounted, the field unit enclosure shall be to IP68 (NEMA IV and NEMA VI). In hazardous area applications it shall be certified to a minimum of EExd IIB T4. The field unit must be located in a separate 'O' ring sealed compartment from the field terminals to preclude the ingress of moisture.

For control room location the field unit shall be 19 inch rack mounting and provided with a suitable 19 inch rack. All connections to the unit shall be to the front.

The General Purpose field unit shall be suitable for an operating temperature range of -30°C to +70°C and +80°C storage.

TEST EQUIPMENT

Hand held test equipment shall be provided to facilitate the testing of installed field units and the setting of field unit parameters. Field unit testers shall be able to emulate master station communication on the 2 wire loop terminals as well as evaluate status and diagnostic information.

Master station test equipment shall be in addition to the master station display and keypad. It shall connect to the RS232 host communication port and be capable of emulating a host system.

A Web based interface shall be available that is suitable for examining the system settings and determining all the field unit parameters. The master station settings shall be adjustable by use of this method and it will allow the recording to file and printing of records showing all system settings. This shall run on any internet enabled PC / Notebook.

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