Technological and measurement unit SEP

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Contents

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1. Service Manual

SEP is a device falling into the PLC – programmable logic controller category. The main area of application is implementation of measuring and regulation functions, controlling technology and data collection.

As opposed to the previously produced MTS074 device, which it replaces, it contains the following improvements:

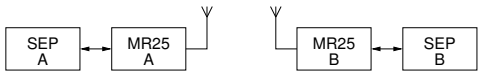
- ADUC812 Analog Devices processor
- FLASH memory facilitating a variety of software and recalibration
- 12 bit resolution of A/D and D/A conversion
- galvanic separation of analog inputs and outputs
- voltage or current inputs and outputs
- communication by SEP protocol (modified MODBUS)
- LED indication of port communication
- 32bit impulse counter with pre-set
- the processor temperature control by special analog channel
- robust all-metal construction
- low spurious emission

1.1. Parameters

Supply voltage	10.6 to 30 V
Current drain	150 to 500 mA according to equipment
Interface	firmly set RS232; optionally RS422 or RS485
Communication speed	19200 bd
Communication protocol	SEP
Digital inputs	8
Comparative level	TTL, *L–H* 2.9 V, *H–L* 1.9 V
Overload capacity	± 12 V
Impulse counting	Separately on each digital input
Length of counter register	32 bits
Active edge	Leading
Frequency of counted pulses	max. 100 Hz
Digital outputs	max. 8
Design	Switching contact relay
Load-carrying capacity	250 VAC, 12 A
Analog inputs	max. 8, unipolar or bipolar
Max. voltage sensitivity	200 mV
Current sensitivity	According to shunt resistor
Actual range	Fixed according to customer requirement
Overload capacity	Ten times set range
Analog outputs	max. 2, unipolar
Voltage variant	0 to 2.5 V
Output resistance	100 Ω
Current variant	0 to 20 mA
Max.load resistance	100 Ω
Temperature dependence of reference voltage source	40 ppm
External source (optional)	1 ppm
Stabilisation of temperature	approx. 10 min
Processor temperature measuring	with differentiation 1°C
Dimensions (w × h × d)	95 × 187 × 50 mm
Weight	approx. 850 g

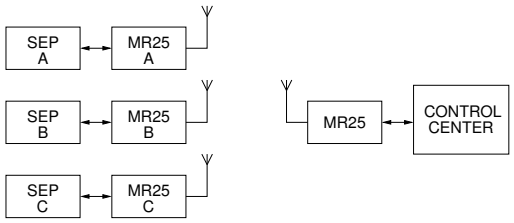
1.2. Connection and Configuration Examples

1. This is the simplest method of connection.

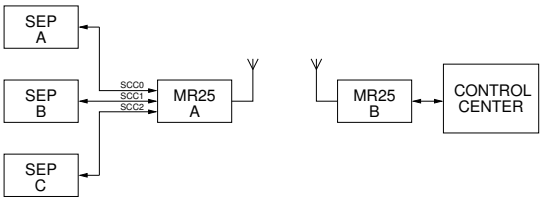


The setting of digital inputs SEP A sets outputs SEP B and vice-versa. The value measured by analog inputs *0* and *1* SEP A will be generated on analog outputs *0* and *1* SEP B and vice-versa.

2. Typical star network “control center ↔ farther slave sites”.



3. Typical star network “control center ↔ near slave sites”.



There is not supported the interconnection of several SEPs by RS485 bus and their linking to one MR25 port. Each SEP must be connected to own communication port of MR25 and there must be configured proper protocol.

1.3. Standard inputs and outputs eguipment

Table below introduce typical and by manufacturer prefered SEP eguipment without another consultation. When ordering is needed specification of iterface type (RS232, RS422 or RS485) and sensitivity of optional analog inputs and outputs.

Example: SEP8882, RS232, all analog inputs 0 to +5 V and outputs 20 mA.

Typ	Digital		Analog	
	inputs	outputs	inputs	outputs
SEP 8000	8	0	0	0
SEP 8400	8	4	0	0
SEP 8800	8	8	0	0
SEP 8820	8	8	2	0
SEP 8842	8	8	4	2
SEP 8882	8	8	8	2

E. g. description `SEP 8040` indicates the SEP, which contains 8 digital inputs, none digital output, 4 analog inputs and none analog outputs.

1.3.1. Non-standard equipment

There is possible to produce SEP variant with arbitrance number of inputs and outputs after consultation with manufacturer.

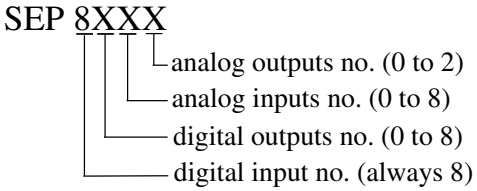


Figure 1.1.: Type description.

1.3.2. Produce label

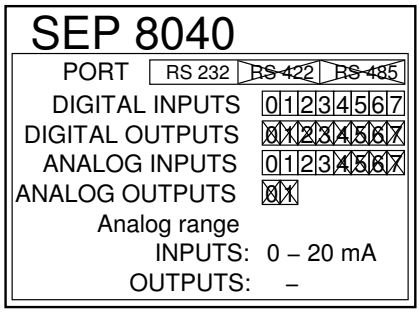


Figure 1.2.: Label describing the type of device

1.4. Commissioning

The source of DC voltage is connected to the POWER SUPPLY terminals. The presence of the supply voltage is indicated by an LED diode.

Galvanic separation of different terminals of the equipment described below serves for limiting spurious currents during analog measuring. Separation of high electrical potentials is not recommended when using this mechanical design.

Connection of the communication port with the higher-level device is implemented through RS232, RS422 or RS485 interfaces. The communication speed in all cases is 19200 bd. For the RS232 variant terminal `TxD` is the output and terminal `RxD` the input. For variant RS422 terminals `Tx+`, `Tx-` are the output and terminals `Rx+`, `Rx-` the input. For variant RS485 data terminals are labelled `RS485a`, `RS485b`. This design does not contain an internal terminator resistor.

Data activity at the communication port for all variants is indicated by LED diodes. The communication port is not galvanically separated from ground terminals of the power supply.

Activation of digital inputs is possible in two ways:

- by grounding the appropriate input e.g. with a contact
- by connecting external TTL voltage

An unconnected input appears as though it has been connected at the H level. Activation of digital inputs is indicated by LED diodes. LED diodes indicate acceptance of activation of the appropriate input by the software, not activation of the respective input processor circuit. Inputs are protected against polarity reversal and overloading. Digital inputs 0–3 and 4–7 have a common ground terminal and are galvanically separated from the adjacent quad and from other device terminals.

Each digital input is also equipped with a software counter, which is incremented by the leading edge of the input impulses. Each counter register is 32 bits long and is set to zero after resetting SEP. Using software it is possible to set each register to an random value in the interval 0 to $2^{32} - 1$.

Digital outputs are implemented with a switching contact relay. Activation of digital outputs is indicated by LED diodes. The LED diodes indicate the command for activation of the appropriate output by software and not activation of respective output circuits of the processor or relay.

The maximum sensitivity of analog inputs is $\pm$200 mV for an input impedance of 500 kΩ. The actual sensitivity, polarity and input impedance for each input is firmly set during manufacture according to customers specifications. Each analog input is galvanically separated from the other terminals of the device.

Each analog output is connected like a voltage source 0 to 2.5 V and likewise as a current source 0 to 20 mA to individual terminals. Such an analog output pair is galvanically separated from the other terminals of the device.

When measuring and setting analog variables the ADUC812 processors internal source of reference voltage is used. For precise measuring it is possible upon request to have an external source of reference voltage with temperature dependence 1 ppm fitted.

1.5. Connection with MR25

1.5.1. Configuration of the SEP protocol in MR25

On the MR25 communication port, to which SEP is connected, the SEP protocol is set and suitable parameters added:

`(d)est` – address of MORSE network node, which represents the higher-level.

Next parameters can be put in range 0 – 255:

`(t)hr` – upon a change of measured analog variables in whichever measuring channel by the value set here against the previous enquiry all measuring is trasferred to address `(d)est`. They are entered in the same units in which they are measured. The recomended start value is 255.

`(c)thr` – on exceeding the content of whichever counter register by the value set here against the previous enquiry all measuring is transferred to address `(d)est`. They are entered in the number of pulses. This parameter can pe put in the range 1 – 255.

`(m)ask` – blocking of binary inputs, valid range is `00` to `FFh` – by setting any bit to the level *0* blocking of the corresponding binary input occurs. Such an input, after an enquiry from the higher-level system, appears as if it would be connected to the level *L*. Counting of impulses and transferring of measuring to address `(d)est` after fulfilment of conditions `(c)thr` is retained.

When `FFh` is put, then all binary inputs are active, when `01h` is put, then binary input `00h` works only.

(e)rr – type of error message for a SEP fault

`(s)ilence` – upon a higher-level system enquiry no reply is sent

`(a)scii` – upon a higher-level system enquiry the ASCII message "`sep is dead`" is sent

`(m)none` – upon a higher-level system enquiry the last know state of SEP is sent

t(i)me – time necessary for sending measured values to address `(d)est` in seconds. At the end of this period measured variables, without regard to change or set threshold values are transferred. The minimum value that can be entered is 10 s.

(f)ilter – smoothing changes of measured variables, equivalent of electronic lowpass filter. If the measured variable contains disturbance, noise or quickly changes, it is possible to smooth it so that unnecessary partial transmissions do not occur when exceeding set thresholds. As a filter the numerical equivalent of a first-order electronic lowpass filter is used.

The respective differential equation has the form:

$$y(n) = ax(n) + by(n-1) \qquad \text{where } a = 1 - b,\ b = e^{-\frac{1}{k}}$$

When entering $k = 0$ there is no filtration. The higher the set value is the more effective the filtration of input variables is.

(p)er – the period of reading inputs and setting outputs on SEP. At the end of this time measured values will be moved from SEP to MR25 and at the same time values obtained from address `(d)est` will be recorded on SEP outputs. Minimum adjustable value 100 ms.

Other items are given in the submenu (T)est

Bin(O)ut – the selected relay closes by setting the appropriate bit or opens by nulling it. It is possible to enter in decimal or hexadecimal (`0xXX`) format.

(A)n out – with a elected value sets the output variable on the analog output 0 nebo 1

(G)et values – reads the current state of SEP; setting outputs and measured variables on all inputs. If some analog input are not available the value `-001` is returned.

(C)ounters – displays the current values in register counters for all binary inputs

1.6. Description of Communication between SEP and MR25

MR25 with a period of `(p)er` enquires about the current setting of digital inputs, the state of counter registers and the values of measured analog variables and with this enquiry hands the SEP information about the setting of digital outputs and output analog variables.

Upon a change of any unblocked digital input against the previous enquiry complete information on the states of all digital and analog inputs is sent. In this way it is possible to use a change of digital input with a suitably set parameter `(t)hr` to trigger measuring of analog variables.

Measured analog variables are in the case of non-zero values of the parameter `(f)ilter` subject to numerical filtration. Absolute values of the differences of measured and previously measured values

are subsequently ascertained. If any difference is greater than the set threshold `(t)hr`, a message is sent to the address of the node given by the parameter `(d)est`. If the difference is less it waits for the next measuring and the whole process repeats. If the difference after each enquiry is less or the analog variable does not change the message is sent after expiry of the period of compulsory sending of measured values `t(i)me`.

The same principle is valid for impulse counters on digital inputs. If the value in any impulse counter register changes by a value greater than is set by parameter `(c)thr` a message is sent to the address given by the parameter `(d)est`.

After receiving a packet from the superior device about setting outputs the MR25 sends this message to SEP with the next enquiry given by the period `(p)er`.

1.7. Description of inputs and outputs