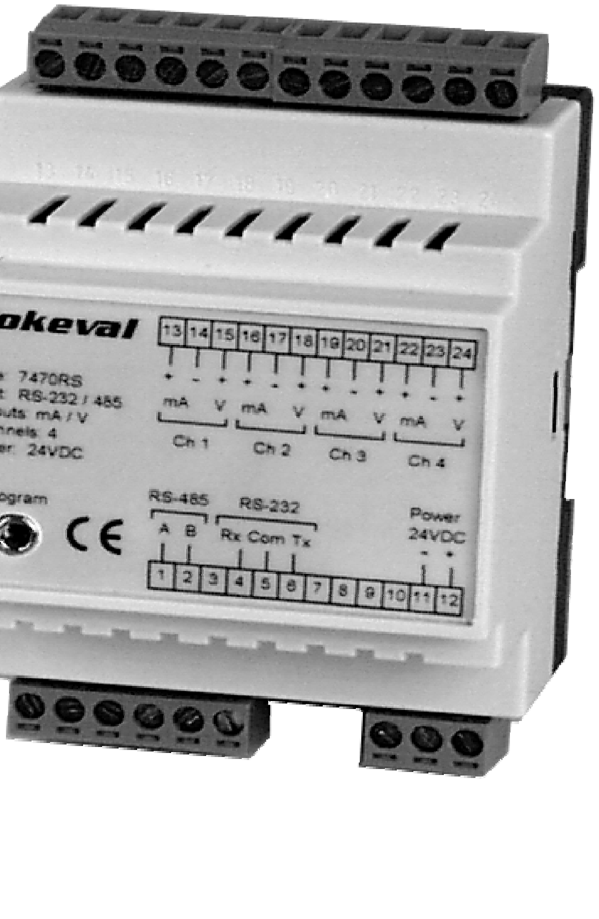
User manual

22.1.2007

V2.0

7470

Serial to analog converter



Nokeval

INTRODUCTION

7470 is a serial-bus controlled analog output unit. It provides four mA or V outputs, that can be controlled via an RS-232 or RS-485 bus. As a slave, it supports Nokeval SCL, Modbus RTU, and Ascii protocols. Alternatively, it can function as a SCL Master querying other devices.

Analog output ranges include 0-20mA, 4-20mA, 0-5V, and 0-10V.

7470 needs 24 VDC supply voltage. The analog outputs are not galvanically isolated from the power supply or each other. They share the common negative wire. However the serial bus is galvanically isolated.

How to use this manual

The chapter General shows how to mount and connect this device. It also tells how to access the configuration settings. The settings itself are described in chapter Configuration menu. Each of the available serial modes are described in the chapters of their own.

Table of contents

Manufacturer

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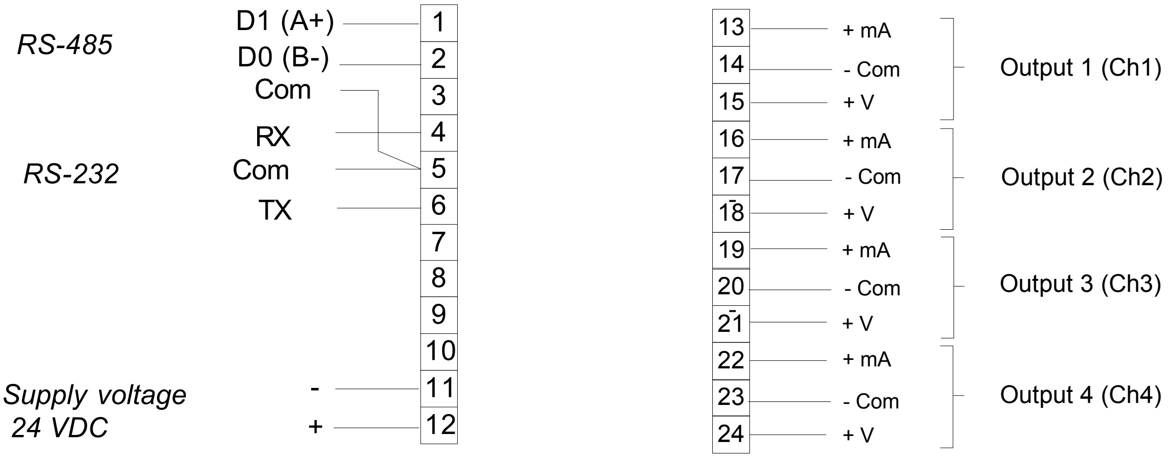
GENERAL

Mounting

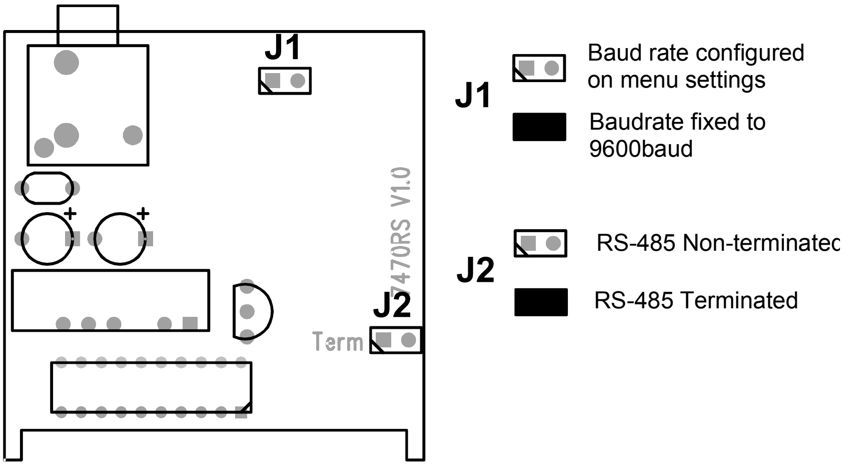
This transmitter is intended to be mounted on a 35 mm DIN rail.

Connections



The green connector blocks are detachable to make connecting easier. They accept up to 2.5mm^2 wires.

Jumpers


J1
J2
7470RS V1.0
Term
J1
Baud rate configured on menu settings
Baudrate fixed to 9600baud
J2
RS-485 Non-terminatec
RS-485 Terminated

Jumper J1 should be normally open. It is closed when the 7470 baud rate is not known, to force 9600 baud.

Jumper J2 engages the RS-485 termination. It should be closed if this device is the last on the bus, otherwise open.

To access the jumpers, the enclosure has to be opened. Detach the converter from the DIN rail and insert a small flat-bladed screwdriver between the top (grey) and bottom (black) parts of the enclosure at each side and pull the top part off.

Configuring

The 7470 can be configured with a PC or with a hand-held programmer.

PC configuration

The configuration settings are accessed with a software called MekuWin, available free of charge.

The configuration settings may be accessed via the RS-232 or RS-485 buses or via the 3.5mm "POL" connector on the front panel.

To use the POL connector, use a POL-RS232 cable or DCS772 USB-to-POL cable.

When the 7470 is configured for SCL (slave) mode, it can be accessed via any port straight away. This is the factory default.

In other modes than SCL (slave), a plug has to be plugged to the POL connector on the front panel to revert the 7470 to the SCL (slave) mode. The plug will also change the baud rate to 9600 and make the 7470 to respond in any bus address. The plug may be the plug of the programming cable, or any 3.5mm mono plug. When the plug is pulled off, 7470 will start using the protocol defined in the configuration menu.

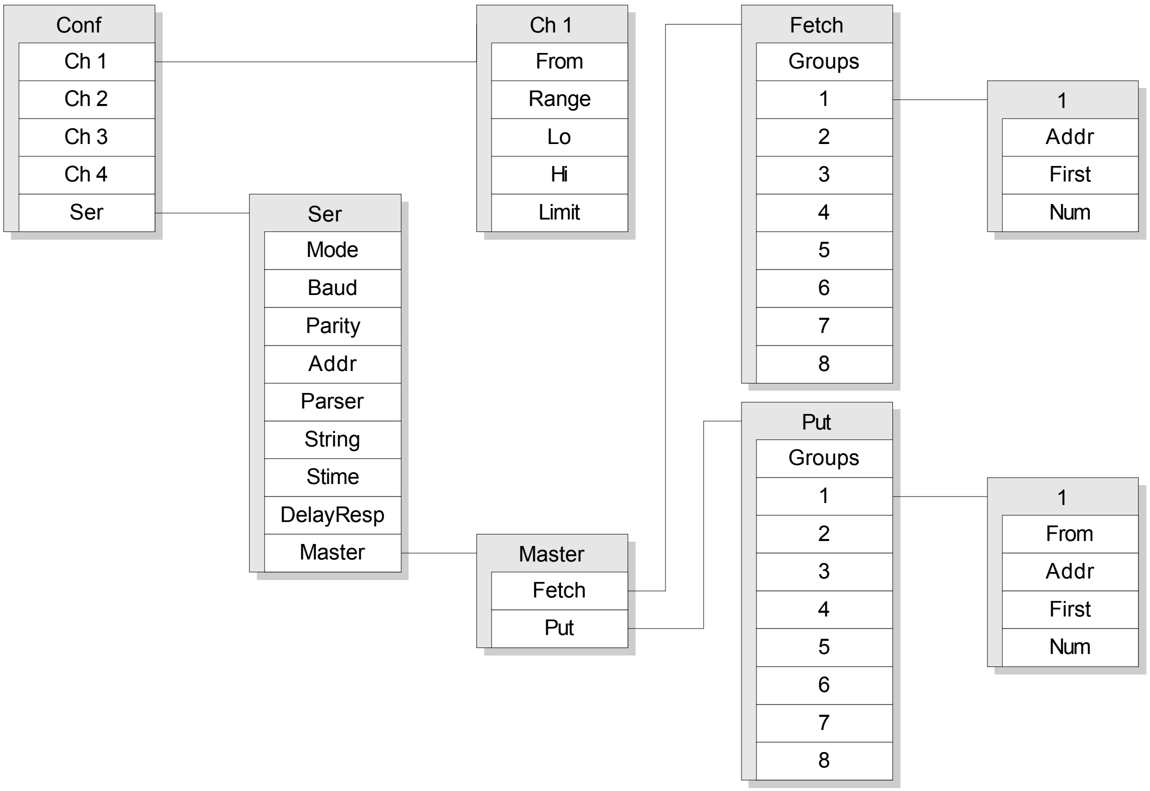
The configuration menu contents are described in the chapter Configuration menu. How to use MekuWin, see its manual.

Hand-held programmer

An alternative to the PC programming is to use a hand-held programmer 6790. It is plugged to the POL connector on the 7470 front panel. The menu contents are described in the chapter Configuration menu. How to use 6790, see its manual.

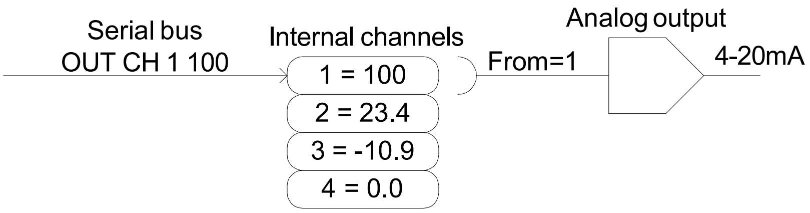
Note: 6790 is not able to edit string type settings, so it can not be used to edit the custom Ascii parser configuration string.

CONFIGURATION MENU



The menu is arranged hierarchically. The first level contains four submenus, one for each analog output, and a serial communications submenu. Some of the settings are hidden when they are not used.

Ch submenus



Each analog output is configured independently.

From

7470 contains 32 internal channels storing the variable values sent via a serial bus. The channels are numbered 1…32. The From setting is used to select, which internal channel is used to control this analog output.

Most often the values are sent to internal channels 1…4, and the first analog output channel follows the first internal channel etc. However, some times it may be useful to be able to have several analog outputs following the same internal channel.

Range

The analog output range selection. Options are:

- **0-20mA**
- **4-20mA**
- **0-5V**
- **0-10V**

Lo, Hi

Analog output scaling. When the channel value controlling the analog output corresponds to the Lo setting, the output will give its low end signal (e.g.

4 mA if the range is 4-20mA). Likewise, the value of Hi will give the high end signal.

Limit

Limits the analog output within the nominal range. If enabled, the analog output will not exceed its end points, e.g. the 4-20mA output will not go below 4 mA nor above 20 mA even if requested to.

If the safety timer expires, the output will go to 0 mA or 0 V despite of this setting.

Ser submenu

Mode

Serial bus protocol and mode.

- **SCL** (slave): Nokeval SCL protocol. 7470 may be controlled using SCL commands, like OUT CH and OUT SCAN. See chapter SCL protocol.
- **Modbus**: Modbus RTU protocol. 7470 may be controlled using "write holding register" and "write multiple registers" functions. All the configuration settings are also accessible. See chapter Modbus protocol.
- **Ascii**: 7470 accepts simple messages with no proprietary protocol. The messages has to end with cr, lf, or both. See chapter Ascii mode.
- **SCL Master**: 7470 acts as a serial bus master, sending commands to the other devices on the bus. Only one device should be a master on a single bus. In this mode, 7470 can read serial bus transmitters and Nokeval RTR970PRO radio receiver without a PC or another master. See chapter SCL Master.
- **Metso HART**: Hart-style protocol. See chapter Metso HART.

Baud

Baud rate 300…19200. All the devices on the bus must have the same baud rate. Factory default is 9600.

Parity

Applicable for Modbus only. Options:

- **8N2**
- **8E1** (recommended, factory default)
- **8O1**

Addr

Serial bus address of this device in SCL (slave), Modbus, and Metso HART modes.

- In SCL mode, legal values are 0…123. Inaddition to the selected address, 7470 will always respond in address 126. When the POL plug is inserted in the front panel, 7470 will respond in any address.
- In Modbus mode, legal values are 1…247.
- In HART mode, legal values are 0…127.

Parser

Parser selection in Ascii mode. Options are:

- **Classic**: Non-configurable parser, equivalent to 7470 firmware versions 1.x.
- **Custom**: Configurable parser.

See chapter Ascii mode.

String

Parser configuration string in Ascii mode, when Custom parser is selected. See chapter Ascii mode.

Stime

Safety timer. Defines a safety time in seconds. If some of the internal channels (see Ch\From on page 5) is not refreshed within this time, the safety timer will expire on that channel. An analog output configured to follow that channel will then go low (0 V or mA). This works in every mode.

The time can be selected from 1 to 60 seconds in 1 second steps. To disable the safety timers, set value of 0 here.

DelayResp

Applies to SCL (slave) mode only. When some other device sends a SCL command to the 7470, it will process the command and send a response as soon as possible, but not earlier than 3.5 characters time from the end of the command. At 9600 baud, this minimum time corresponds to 3.6 ms.

If DelayResp is engaged, the interval between the command and response is increased to 25 ms.

Master

The submenu used to configure how this device acts as a SCL Master. See chapter SCL Master.

SCL PROTOCOL

A more detailed description of the Nokeval SCL protocol can be downloaded from Nokeval WWW site.

This unit understands the following SCL commands:

TYPE ?

Returns the model name and software version ”7470 V2.0” without the quotation marks.

SN ?

Returns the serial number, e.g. ”A123456”.

OUT CH 1 100.0

Sends a value of 100 to the internal channel 1. Channels 1…9 are writable this way, although normally up to four of them are used since 7470 has four analog outputs. About internal channels, see the From setting on page 5.

7470 will return an empty response (ACK, ETX, BCC).

Acceptable characters are 0…9, minus, decimal point, and leading or trailing spaces. A deliberately invalid value (NaN) can be expressed as ----- (several minus chars) to steer the analog output to 0 V or 0 mA to indicate something is wrong.

OUT SCAN 1 4 10 20 30 40

Sends several values to the internal channels 1 to 4 (give the first and the last). Maximum of 8 values can be sent with one command; channels 1…9 can be accessed this way. The values are separated with one or more spaces.

MN xxxxx

Commands used by the Mekuwin configuration software.

N xxxxx

Nopsa commands encapsulated in SCL. See chapter Nopsa.

MODBUS PROTOCOL

Commands

- 3 Read Holding Registers: read current configuration
- 6 Write Single Register: change the configuration and control the outputs
- 16 Write Multiple registers: change several registers.
- 17 Report Slave ID: device type query.
- 109 Meku: Mekuwin uses this.
- 110 Nopsa: Nopsa commands.

Maximum Modbus frame is 100 bytes.

Command 17 returns 0x11 <bytecount> 0x00 0xFF, and then ”7470 V2.0 A123456”, for example.

Data types

- BOOL: Off/On setting. 0=off, 1=on on the lower byte.
- BYTE: Single byte value. Only the lower (least significant) byte used.
- WORD: 16-bit value. Most significant byte first.
- ENUM: List of options.
- FLOAT: 32-bit floating point IEEE 754. Least significant word first. Inside the word, most significant byte first.

Holding registers

The analog outputs can be controlled via registers 0..7 in IEEE-754 format, or alternatively via registers 1000..1003 in regular 16-bit signed integer format. These correspond to the internal registers 1…4, see page 5.

The configuration settings are accessible in register 2000 onwards. When the configuration is changed, the changes are automatically stored in the EEPROM. If the serial configuration is changed via Modbus, the new settings do not affect until powered down.

Register	Name	Type	Values
0..1	Ch1	FLOAT	Signed
2..3	Ch2	FLOAT	Signed
4..5	Ch3	FLOAT	Signed
6..7	Ch4	FLOAT	Signed
1000	Ch1	WORD	Signed
1001	Ch2	WORD	Signed
1002	Ch3	WORD	Signed
1003	Ch4	WORD	Signed
2000	Conf\Ch 1\From	BYTE	Unsigned 1...32
2001	Conf\Ch 1\Range	ENUM	See table E1
2002..2003	Conf\Ch 1\Lo	FLOAT	Signed
2004..2005	Conf\Ch 1\Hi	FLOAT	Signed
2006	Conf\Ch 1\Limit	BOOL	
2007	Conf\Ch 2\From	BYTE	Unsigned 1...32
2008	Conf\Ch 2\Range	ENUM	See table E1
2009..2010	Conf\Ch 2\Lo	FLOAT	Signed
2011..2012	Conf\Ch 2\Hi	FLOAT	Signed
2013	Conf\Ch 2\Limit	BOOL	
2014	Conf\Ch 3\From	BYTE	Unsigned 1...32
2015	Conf\Ch 3\Range	ENUM	See table E1
2016..2017	Conf\Ch 3\Lo	FLOAT	Signed
2018..2019	Conf\Ch 3\Hi	FLOAT	Signed
2020	Conf\Ch 3\Limit	BOOL	
2021	Conf\Ch 4\From	BYTE	Unsigned 1...32
2022	Conf\Ch 4\Range	ENUM	See table E1
2023..2024	Conf\Ch 4\Lo	FLOAT	Signed
2025..2026	Conf\Ch 4\Hi	FLOAT	Signed
2027	Conf\Ch 4\Limit	BOOL	
2028	Conf\Ser\Mode	ENUM	See table E2
2029	Conf\Ser\Baud	ENUM	See table E3
2030	Conf\Ser\Parity	ENUM	See table E4
2031	Conf\Ser\Addr	BYTE	Unsigned 0...127
2032	Conf\Ser\Parser	ENUM	See table E5
2033..2048	Conf\Ser\String	STRINGZ	Len=32
2049	Conf\Ser\Stime	BYTE	Unsigned 0...60
2050	Conf\Ser\DelayResp	BOOL	
2051	Conf\Ser\Master\Fetch\Groups	BYTE	Unsigned 0...8
2052	Conf\Ser\Master\Fetch\1\Addr	BYTE	Unsigned 0...255
2053	Conf\Ser\Master\Fetch\1\First	BYTE	Unsigned 0...255
2054	Conf\Ser\Master\Fetch\1\Num	BYTE	Unsigned 0...8
2055	Conf\Ser\Master\Fetch\2\Addr	BYTE	Unsigned 0...255
2056	Conf\Ser\Master\Fetch\2\First	BYTE	Unsigned 0...255
2057	Conf\Ser\Master\Fetch\2\Num	BYTE	Unsigned 0...8
2058	Conf\Ser\Master\Fetch\3\Addr	BYTE	Unsigned 0...255
2059	Conf\Ser\Master\Fetch\3\First	BYTE	Unsigned 0...255
2060	Conf\Ser\Master\Fetch\3\Num	BYTE	Unsigned 0...8
2061	Conf\Ser\Master\Fetch\4\Addr	BYTE	Unsigned 0...255
2062	Conf\Ser\Master\Fetch\4\First	BYTE	Unsigned 0...255
2063	Conf\Ser\Master\Fetch\4\Num	BYTE	Unsigned 0...8
2064	Conf\Ser\Master\Fetch\5\Addr	BYTE	Unsigned 0...255
2065	Conf\Ser\Master\Fetch\5\First	BYTE	Unsigned 0...255
2066	Conf\Ser\Master\Fetch\5\Num	BYTE	Unsigned 0...8
2067	Conf\Ser\Master\Fetch\6\Addr	BYTE	Unsigned 0...255
2068	Conf\Ser\Master\Fetch\6\First	BYTE	Unsigned 0...255
2069	Conf\Ser\Master\Fetch\6\Num	BYTE	Unsigned 0...8
2070	Conf\Ser\Master\Fetch\7\Addr	BYTE	Unsigned 0...255
2071	Conf\Ser\Master\Fetch\7\First	BYTE	Unsigned 0...255
2072	Conf\Ser\Master\Fetch\7\Num	BYTE	Unsigned 0...8
2073	Conf\Ser\Master\Fetch\8\Addr	BYTE	Unsigned 0...255
2074	Conf\Ser\Master\Fetch\8\First	BYTE	Unsigned 0...255
2075	Conf\Ser\Master\Fetch\8\Num	BYTE	Unsigned 0...8

2076	Conf\Ser\Master\Put\Groups	BYTE	Unsigned 0...8
2077	Conf\Ser\Master\Put\1\From	BYTE	Unsigned 1...32
2078	Conf\Ser\Master\Put\1\Addr	BYTE	Unsigned 0...255
2079	Conf\Ser\Master\Put\1\First	BYTE	Unsigned 0...255
2080	Conf\Ser\Master\Put\1\Num	BYTE	Unsigned 0...8
2081	Conf\Ser\Master\Put\2\From	BYTE	Unsigned 1...32
2082	Conf\Ser\Master\Put\2\Addr	BYTE	Unsigned 0...255
2083	Conf\Ser\Master\Put\2\First	BYTE	Unsigned 0...255
2084	Conf\Ser\Master\Put\2\Num	BYTE	Unsigned 0...8
2085	Conf\Ser\Master\Put\3\From	BYTE	Unsigned 1...32
2086	Conf\Ser\Master\Put\3\Addr	BYTE	Unsigned 0...255
2087	Conf\Ser\Master\Put\3\First	BYTE	Unsigned 0...255
2088	Conf\Ser\Master\Put\3\Num	BYTE	Unsigned 0...8
2089	Conf\Ser\Master\Put\4\From	BYTE	Unsigned 1...32
2090	Conf\Ser\Master\Put\4\Addr	BYTE	Unsigned 0...255
2091	Conf\Ser\Master\Put\4\First	BYTE	Unsigned 0...255
2092	Conf\Ser\Master\Put\4\Num	BYTE	Unsigned 0...8
2093	Conf\Ser\Master\Put\5\From	BYTE	Unsigned 1...32
2094	Conf\Ser\Master\Put\5\Addr	BYTE	Unsigned 0...255
2095	Conf\Ser\Master\Put\5\First	BYTE	Unsigned 0...255
2096	Conf\Ser\Master\Put\5\Num	BYTE	Unsigned 0...8
2097	Conf\Ser\Master\Put\6\From	BYTE	Unsigned 1...32
2098	Conf\Ser\Master\Put\6\Addr	BYTE	Unsigned 0...255
2099	Conf\Ser\Master\Put\6\First	BYTE	Unsigned 0...255
2100	Conf\Ser\Master\Put\6\Num	BYTE	Unsigned 0...8
2101	Conf\Ser\Master\Put\7\From	BYTE	Unsigned 1...32
2102	Conf\Ser\Master\Put\7\Addr	BYTE	Unsigned 0...255
2103	Conf\Ser\Master\Put\7\First	BYTE	Unsigned 0...255
2104	Conf\Ser\Master\Put\7\Num	BYTE	Unsigned 0...8
2105	Conf\Ser\Master\Put\8\From	BYTE	Unsigned 1...32
2106	Conf\Ser\Master\Put\8\Addr	BYTE	Unsigned 0...255
2107	Conf\Ser\Master\Put\8\First	BYTE	Unsigned 0...255
2108	Conf\Ser\Master\Put\8\Num	BYTE	Unsigned 0...8

Table E1

Value	Range
0	0-5V
1	0-10V
2	0-20mA
3	4-20mA

Table E2

Value	Mode
0	SCL
1	Modbus
2	Ascii
3	SCL Master
4	Metso Hart

Table E3

Value	Baud
0	300
1	600
2	1200
3	2400
4	4800
5	9600
6	19200

Table E4

Value	Parity
0	8E1
1	8O1
2	8N2

Table E5

Value	Parser
0	Classic
1	Custom

ASCII MODE

Some weighs and weather transmitters are able to output their readings in "Ascii", which means human-readable data terminated by a cr or lf or both. 7470 can receive and interpret most of this kind messages. The transmitter has to be configured to send its readings automatically – 7470 does not send query commands. 7470 will not respond to Ascii packets.

Several 7470's can be parallel-connected to a RS-485 bus to receive the Ascii messages. Each one can be configured to handle a different part of the message. Ascii mode does not use any addressing nor checksum. However some addressing may be realized with the custom parser, see below.

Ascii packets can be sent with any terminal software, e.g. HyperTerminal supplied with Windows.

7470 expects 8 data bits and none parity (8N1), but it discards the most significant bit. So it accepts 7E1 and 7O1 too but does not check the parity.

There is two parsers (algorithms that split the Ascii message to fields and tries to find numerical values there): "classic" and "custom".

The classic parser does not allow any configuration, but it is simple to use. It can be used when the message contains values separated by spaces, commas, semicolons, or tabulators. When more control is needed, the custom parser gives more freedom.

Classic parser

If the message is simple like this:

```
100.0,200.0,300.0,400.0<cr><lf>
```

7470 is able to handle it with the classic parser. The fields may be separated with one comma, one semicolon, one tabulator, or one or more spaces.

If there is non-numerical characters within the field, 7470 will ignore them until a numerical character (0…9, minus, decimal point) is encountered. It will then read in the figure until a field separator or any other non-numerical character is encountered. So, 7470 is able to read this message:

```
A=100.0, B=200.0, C=300kg, D=400m2, E=0
```

Reading of 100.0 is read to the internal channel 1, 200.0 to channel 2, etc. m2 is ignored because one numeric portion has been already found in that comma-separated field.

The maximum length of a message is 100 characters. Up to 32 fields may be read in to the internal registers. The analog outputs can be programmed to follow any of these internal registers.

Custom parser

If the message is not field-separated (delimited) by a comma, space, semicolon, or tabulator, the custom parser has to be used. Also, if the transmitter sends several different types of packets and only one of them is to be picked by a certain 7470, the custom parser is needed.

The custom parser is configured with one string, that contains instructions to 7470 how to handle the message. The parser string consists of the following parts:

Part	Name	Description
*	Replace string	Any number of characters in the message will be ignored until a character following the * is encountered in the message. E.g. *+ will ignore all characters in the message until a + is found. The + will be ignored too.
?	Replace character	One character will be ignored in the message. Several ?'s may be used contiguously to ignore more characters.
%1	Pick	Picks a value to the internal channel 1 from the message. Will pick until a character following the %1 is encountered in the message. E.g. %1, will pick characters until a comma is found in the message. The comma will be ignored then. The channel number may be 1…32. If the message contains non-numerical characters when the picking starts, they will be ignored until a numerical character is encountered.
any other	Match	If the parser string contains other characters, the input string must have equivalent characters, or the parser will exit. This feature can be used to pick a certain type of packet, if the transmitter sends several different packets. When the parser exits, all the fields handled before exiting will be still used.

Some examples will clarify things up.

Simple message

Consider a message like:

```
10,20,30,40
```

To read this in, enter a parser string:

```
%1,%2,%3,%4
```

(A comma-separated message could be handled by the classic parser too.)

Custom delimiter

If the message is separated (delimited) with e.g. slashes like this:

```
10/20/30/40<cr>
```

The parser string that can interpret this to the four first channels:

```
%1/%2/%3/%4
```

If the delimiter is * or ? or %, it can't be mentioned directly in the parser string, because those characters have a special meaning to the parser. They must be escaped by preceding them with a %. A message separated by *'s would be handled by a parser string like this:

```
%1%*%2%*%3%*%4%*
```

Ignoring fields

If we have a message like:

```
10,20,30,40,50,60,70,80
```

And want to read in the third and fifth field only, enter the following parser string:

```
*,*,%1,*,%2
```

Ignoring characters

Consider a message:

```
W=10,H=22,L=50
```

To ignore the letters and the equivalent signs, this kind of parser string can be used:

```
??%1,??%2,??%3
```

Or, if we want to be sure the letters and equivalent signs are there and they are correct:

```
W=%1,H=%2,L=%3
```

Note: since 7470 is able to ignore the non-numerical characters within the field, the message can be read in with this simple parser string:

```
%1,%2,%3
```

Addressing

If the transmitter sends several different types of messages, and we want to accept only one of them, we have to insert some "fixed" characters in the beginning of the parser string.

An example: the transmitter sends alternately two packets:

```
0;10,20
1;30,40
```

If we want to accept the latter message only, we enter the parser string this way:

```
1;%1,%2
```

Now, when the transmitter sends a message 0;10,20, the parser will reject it because it does not match 1; mentioned in the parser string.

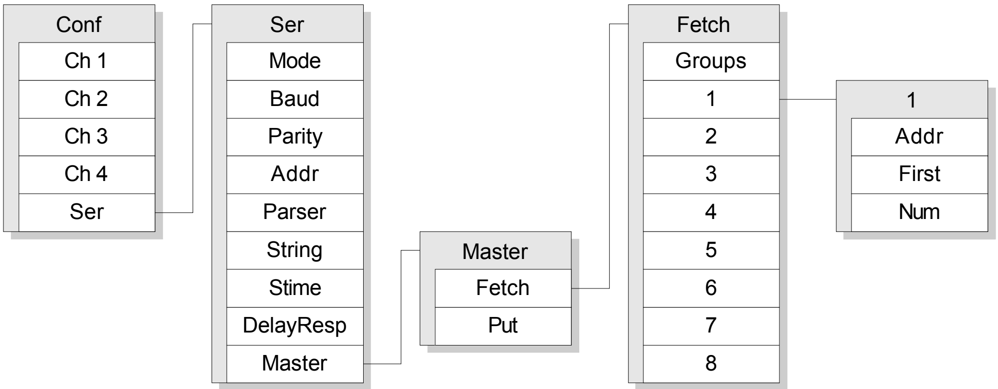
SCL MASTER

When there is no PC or any other device available that could "master" the bus (i.e. command the bus devices), one 7470 can be configured to act as a master. It can read values from other devices on the bus and redirect them to another devices. The four analog outputs of the mastering 7470 are available too.

There must always be exactly one master on the bus. If there is no master at all, all the devices listen only. If there is two or more masters, they will collide.

The master does not have an address of its own. Only the slaves use an address. Every slave must be configured to a different address.

Fetching



Fetching means querying values from other devices on the bus. These devices are most often transmitters measuring temperature, voltage, current etc. Also Nokeval RTR970PRO radio receiver can be read.

The fetch operations are configured in the menu Ser\Master\Fetch. There may be up to eight fetch groups. One group corresponds to one serial command sent to another bus device, and it may fetch up to eight values.

The first setting, Groups, is used to select how many fetch groups are needed.

Within each group, there is three settings. Addr defines the serial bus address of the other device. First tells from which channel to read on the other device, and Num tells how many channels to read.

The values fetched with group 1 are stored in the internal channels 1 onwards. The values fetched with group 2 are stored in the next "free" internal channels etc. E.g. if group 1 fetches 4 channels and group 2 fetches another 4, the values will be placed in internal channels 1…4 and 5…8, respectively.

The fetches may be configured freely. It is allowed to do several fetches from the same bus device (e.g. to fetch more than 8 values from a 16-channel transmitter).

Every time a fetch is done successfully, the safety timers of the updated internal channels are reset. If some channel is not updated for a time specified in Stime setting in the Ser submenu, that channel will be considered expired. If an analog output is following that channel, it will be pulled to 0 mA or 0 V.

Putting

7470 is able to send or put the fetched values to other devices on the bus. E.g. one 7470 can read 16 channels from a temperature transmitter and then deploy the values to other 7470's to have more than 4 analog outputs.

Up to eight put groups may be defined. Each group corresponds to one serial command sending up to eight values to another device on the bus.

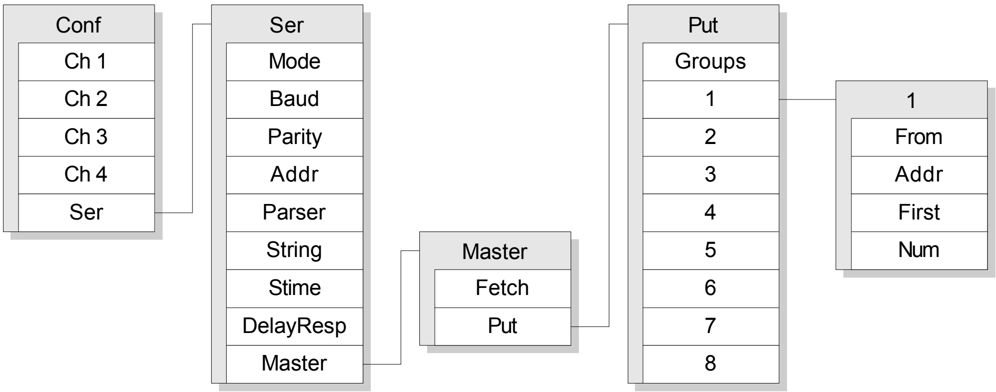
The first setting, Groups, is used to define how many put groups are needed.

Within each group, there is four settings. Addr defines the bus address of the other device. First tells the first channel on the other device that the valueas are sent to. Num tells how many values to send.

From defines the internal channel of this 7470 that provides the first value to be sent. For example, if configured as follows:

- From = 5
- Addr = 2
- First = 1
- Num = 4

The mastering 7470 will send values from its internal channels 5…8 to the channels 1…4 of the device on bus address 2.



If some internal channel has expired, dashes ----- will be sent to indicate fault.

METSO HART

7470 can be controlled using the Hart protocol on RS-485 bus. Supported command set is minimalistic: commands 0 and 206. As always with Hart, odd parity 8O1 is used.

7470 accepts only the long address, not the ”polling address”. Manufacturer ID is 47d or 2Fh (Valmet/Metso). Device type byte is 01h. The two most significant bytes of the address are zero, and the least significant is selectable on the configuration menu Ser\Addr, selectable 0..127d.

This device needs 2 preambles and sends 5.

Command 0: Read Unique Identifier

This command is useful to see the device exists on the bus.

Command 206: Controlling the outputs

The analog outputs are controlled with this command. After the command byte 206d or CEh comes one byte indicating the number of data bytes. It may have the following values:

- 04h: control the output 1 only
- 08h: control the outputs 1..2
- 0Ch: control the outputs 1..3
- 10h: control the outputs 1..4

After that comes 32-bit floating point numbers in IEEE754 format the most significant or exponent byte first.

An example of the whole frame (in hexadecimal):

FF	FF	82	AF	01	00	00	00	CE	10	40	00	00	00	40	C0	00	00	41	40	00	00	41	C0	00	00	B2
Pream		D	Mf	T	ID			C	Bc	Out1 = 2				Out2 = 4				Out3 = 8				Out4 = 16				LP

- Mf = six lowest bits of manufacturer id, and most significant bit set for primary master
- T = device type, always 01h
- ID = 000000h + the address selected in the configuration
- C = command
- Bc = byte count
- LP = longitudinal parity

The device will respond:

5xFF	86	AF	01	00	00	00	CE	02	00	00	E4
Pream	D	Mf	T	ID			C	Bc	St1	St2	LP

Possible errors are:

- Longitudinal parity error, status bytes 88 00 (in hexadecimal)
- Command not implemented 40 00

If the analog outputs are requested to go outside their range, they will go as far they can (Limit=off) or tho the end of the range (Limit=on). No error is given.

NOPSA

Nopsa is a simple language intended for data interchange between devices. The data is transferred in binary format, making it ideal for machine-to-machine communications. 7470 allows Nopsa commands to be sent over SCL and Modbus protocols.

Nopsa is specified in a separate document, available on request.

This device supports the following Nopsa commands:

- 1/0: Type query, returns ”7470”.
- 1/1: Software version query, returns ”V2.0”.
- 1/2: Serial number query, returns ”A123456”.
- 1/3: Description query, returns ”Analog output unit”.
- 1/32: Meku configuration commands over Nopsa.
- 2/2: Control the analog outputs. Floating point format only supported.
- 2/3: Information on the outputs.

SPECIFICATIONS

Outputs

Channels	4 outputs
Isolation	Non-isolated from each other and power. Common negative wire.

mA output

Ranges	0-20mA and 4-20mA
Accuracy at 25°C	0.1% of range
Operating range	0..22mA typ
Maximum load	600 ohms

V output:

Ranges	0-5V and 0-10V

Accuracy at 25°C	0.1% of range
Operating range	0..11.1V typ
Maximum load	5 kilo-ohms
Shortcircuit protect	yes (~15mA)

Response time

Output reaction time	0-40ms
Output timing	4.7ms +reaction 0-40ms (67% of end value) 12.5ms +reaction 0-40ms (93% of end value) 150ms +reaction 0-40ms (100% of end value)

Serial ports

Buses	RS-232, RS-485
Protocol	Nokeval SCL, Ascii, Modbus RTU
Baud rates	300…19200 bauds

Response time	1-5 ms
Termination	Externally with a resistor or internally with a jumper

General

Temp stablility	50ppm/°C of range
DA conversion	12 bits (resolution 4096)
Supply voltage	18…28VDC
Curr consumption	30mA…110mA

Oper temperature	0…55 °C
Protection	IP20
Attachment	35 mm DIN rail
Weight	140g

Dimensions