Interface definition *RISH*Ducer **M40**	RISHABH

Contents

lessages for the configuration :

- Request: Changing the upper range limit of analog output A to 105% of the rated value

Device	Code	Register		Number of registers		Number of bytes	Data		Checksum	
		HByte	LByte	HByte	LByte		HByte	LByte	LByte	HByte
07H	10H	00H	20H	00H	01H	02H	29H	04H	CRC16	

Device response:

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07H	10H	00H	20H	00H	01H	CRC16	

TTENTION:

ollowing each step changing parameters the transducer starts up to initialize the new configuration. uring about 3 seconds the transducer cannot handle communication requests.

. Error messages

the receiver of a message selects an error he sends back an appropriate error message to the master.

Device response:

Device	Code	Data	Checksum	
			LByte	HByte
07H	Code+80H	*error code*	CRC16	

he device sends the received function code back. However, to signal the error the most significant bit (MSB) of ne function code byte will be set. The error code always signals a programming or operating error (never a ansmission error). The following error codes will be used:

Error code	Meaning
01H	Use of a unsupported function code
02H	Use of an invalid memory register address: Use of invalid register number or attempt to write to a memory protected register.
03H	Use of invalid data, i.e. an invalid number of registers
06H	Device is busy. This code signals that the transducer is occupied with functions perfomed via the local RS232 interface. These may be: changing configuration simulation or calibration of analog outputs.
0AH	Possible change of rated values. The device configuration has been modified since the last request for measurands or this is your first request for measurands since the transducer was switched-on. You have to read the table of measurands to the evaluated (table 1) and the scaling factors table (again).

a transmission error occurs of that kind that the receivers crc16 calculation does not match the received ne, by no means a response is sent to the master therefore provoking a timeout. The same happens if a on existing or switched-off device will be addressed.

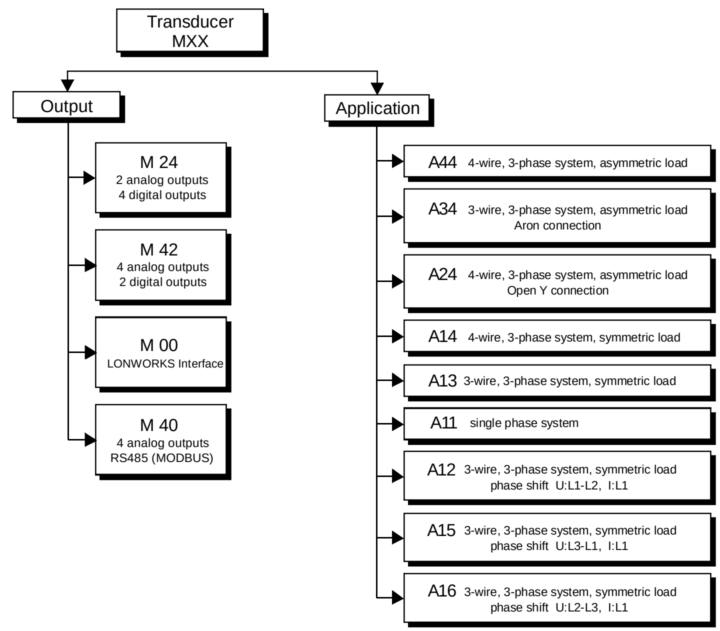
1. Introduction

The MXX series of multi-transducers simultaneously measure several variables of an electric power system. Th grafic below shows all of the available device versions. The main feature of the RISHDucer M40 is a built-i RS485 interface with MODBUS® protocol which provides the following functions:

- Interrogation of a free selectable number of measurands (till the maximum of available values)
- Interrogation/setting/resetting of programmed internal meters (maximum 4)
- Configuration of all relevant parameters of the transducer including measurands and characteristic of th analog outputs, rated input values, measurands to evaluate for bus interrogation, meter measurands etc.
- Resetting possibly defined slave pointers

An operation via standard interface EIA485 is possible, no termination is required. You can use an interfac converter RS232<->RS485 or an RS485 interface card to connect the PC to the bus.

The M 40 provides also 4 analog current or voltage outputs. Via the additionally built-in RS232 interface a the above descripted functions can be performed as well. For bus service it's essential that device addres baudrate and a possible prolongation of the silent interval defined in the MODBUS® protocol can be configure via this interface.



This document specifies only the RS485 bus interface between a PC and the transducer for electrical variable M 40. Bus communication is done via protocols in accordance with MODBUS® specification.

MODBUS® - Modbus is a registered trademark of Schneider Automation Inc.

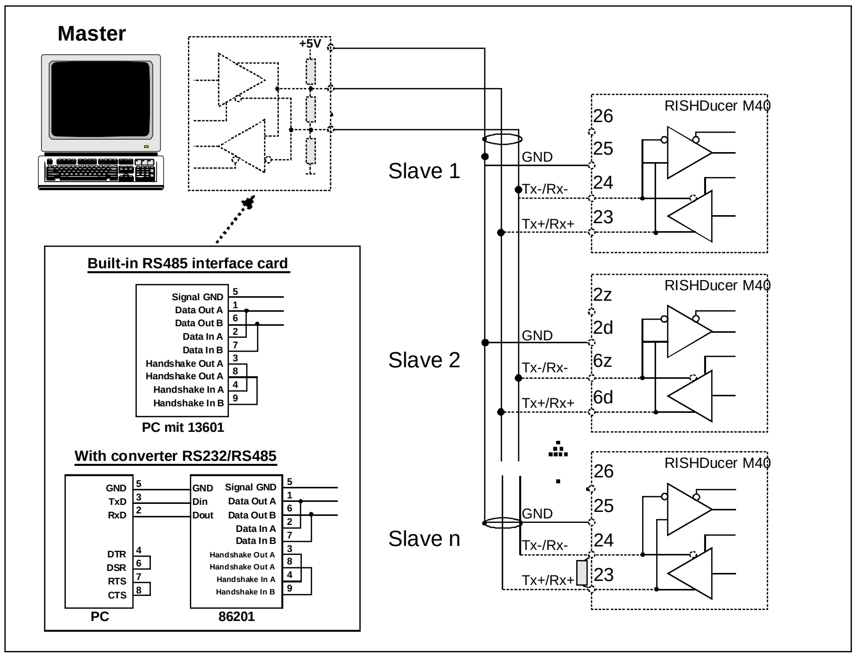
. Connecting devices to the bus

he RS485 interface of the RISHDucer M40 is galvanically isolated from all other circuits. For an optimal data ansmission the devices are connected via a 3-wire cable, consisting of a twisted pair cable (for data lines) and a hield. There is no termination required. A shield both prevents the coupling of external noise to the bus anc nits emissions from the bus. The shield must be connected to solid ground.

ou can connect up to 32 members to the bus (including master). Basically devices of different manufacturers an be connected to the bus, if they use the standard MODBUS® protocol. Devices without galvanically isolated us interface are not allowed to be connected to the shield.

he optimal topology for the bus is the daisy chain connection from node 1 to node 2 to node n. The bus musı ›rm a single continuous path, and the nodes in the middle of the bus must have short stubs. Longer stubs woulc ave a negative impact on signal quality (reflection at the end). A star or even ring topology is not allowed

here is no bus termination required due to low data rate. If you got problems when using long cables you can ›rminate the bus at both ends with the characteristic impedance of the cable (normally about 120). Interface onverters RS232⇔RS485 or RS485 interface cards often have a built-in termination network which can be onnected to the bus. The second impedance then can be connected directly between the bus terminals of the evice far most.



he grafic shows the connection of transducers RISHDucer M40 to the MODBUS® . The RS485 interface can be ›alized by means of PC built-in interface cards or interface converters. Both is shown using i.e. the interfaces .3601 and and '86201' of W&T (Wiesemann & Theis GmbH). They are configured for a 2-wire application with utomatic control of data direction. These interfaces provide a galvanical isolation and a built-in terminatior etwork.

Important :

- ***Each device connected to the bus must have a unique address***
- ***All devices must be adjusted to the same baudrate***

char Flieinfo[94]

User defined text for a, device description. You can use characters with ASCII code higher than 32 or the value for unused characters at the end of the text. In the standard software DME4 this text is normally divided into 3 line The position of the linefeed is realized with the characters <CR> and <LF> (ASCII code 13 and 10). Thes characters are part of *'Fileinfo'* and therefore the maximum of usable characters is reduced to 94 characters.

<u>The following parameters are</u> ***<u>'read only':</u>***

BYTE OutpType[4]   (M 40 only)

Specifies the kind of analog outputs A..D. Valid arguments are 1 (current output) and 2 (voltage output). All oth values should **be** interpreted as non existing outputs. These parameters have no influence on the device functic and are used for display functions only.

WORD Y2HW[4]   (M4o only)

The hardware range limits of the analog outputs are **fixed by** the PCB assembly. The format is the following:

- Voltage output: $\text{Upper\_range\_limit[V]} * \frac{10000}{10[V]}$

- Current output: $\text{Upper\_range\_limit[mA]} * \frac{10000}{20[mA]}$

BYTE DeviceType

Always 40 (DME440).

BYTE CalFreq

Contains the information for what rated frequency the transducer'is calibrated. This frequency should be the sam as defined in 'Freqmeas' otherwise permissible variations will increase.

7	6	5	4	3	2	1	0

Calibration frequency 55 Hz ┘ (bit 3)
Calibration frequency 60 Hz (bit 2)
Calibration frequency 50 Hz (bit 1)
└Calibration frequency 16 2/3 Hz (bit 0)

char Password[8]

User defined password. Ailowed characters are those with ASCII code 32 to 127. If password protection should t inactiv set all characters to 32 (space). Use the password protection to prevent from unpermitted modifications transducer data. See 'PasswValidity' to know for what operations password protection will be activ.

BYTE PasswVaildity

Defines for what operation the password protection mechanism will be valid:

7	6	5	4	3	2	1	0

└Storing a new configuration
└Setting meters
└ Resetting slave pointers
└Performing a customer output calibration
└ Simulation of output values

BYTE CalVers

Version of used calibration prograrn **(0..255)**

BYTE EPROMYers[2]

EPROM version, [0]=high_byte, [1]=low_byte

ıt YA[4][3] (DME440only)

ˡere you can define the lower and the upper range limits and if necessary the break points of the analong outputs. he upper range limit Y2 is always 10'000 (100% of the output) and therefore don't have to be programmed.

YA[A,B,C,D][Y0,Y1,Y2SW]

Lower range limit Y0 and break point Y1 are proportional in the range - 10'000..10'000

If there is no break point Y1 is 15'291 (3BBB$_H$)

Using Y2SW you can reduce the output value by software:

YA[A,B,C,D][Y2SW] = 10'000 — if Y2 corresponds to the rated value of hardware output

$$\text{YA[A,B,C,D][Y2SW]} = \frac{\text{desired range limit}}{\text{hardware range limit}} * 10'000$$

if Y2 doesn't correspond to the rated value of hardware output

For unused or non existing analog outputs all values should be set to zero

xamples fo YA[ ] [ ] :

- Output A, configured 4..20 mA linear, hardware 20 mA
  - YA[0][0] = 2'000 (20% of the configured upper range limit)
  - YA[0][0] = 15'291 (no break point defined, linear)
  - YA[0]92] = 10'000 (configured upper range limit = hardware range limit)
- Output B, configured 16..16 mA linear, hardwere 20 mA
  - YA[0][0] = 10'000 (-100% of the configured upper range limit)
  - YA[0][0] = 15'291 (no break point defined, linear)
  - YA[0][2] = 8'000 (configured upper range limit = 8'000/10'000 *20mA = 16 mA)
- Output C, configured 2..10V linear, hardwere 10V, break point at 2V
  - YA[2][0] = 2'000 (20% of the configured upper range limit)
  - YA[2][1] = 15'291 (break point at 20% of the configured upper range limit)
  - YA[0]92] = 10'000 (configured upper range limit = hardware range limit)

VORD Ydel [12]

here's the possibility to define a response time for each rneasurand. You have to distinguish betweer ıeasurands with short response time (1..30 s) and those with long response time (1..30 min). Unused elements hould be set to zero. The assignment of the elements to the outputs is the following:

Tein	[0]	[1]	[2]	[3]	[4]..[11]
DME440/402	**A**	**B**	**C**	**D**	**Not used**

[0]...[3]: Analog outputs (DME440 only) **[4]...[11]:** not used

he range of values is 1'000..30'000 [ms] for those measurands with short response time. To choose minima esponse time you can set the value to zero.

or birnetal measuring functions and slave painters the range is 1..30 min ('1000), zero is not allowed.

ıt Y0Limit [4] (DME440 only)

ower range limit of the analog outputs. The range of values is {YA[i][0]-2'500}...YA[i][0]. So the range limit can e maximum 25 % below the configured lower range limit of the output (Y0). For non existing analog outputs set ıe appropriate element to zero.

ıt Y2Limit[4] (DME440 only)

ıpper range limit of the analog outputs. The range of values is 10'000..12'500 representing 100..125 % of the onfigured upper range limit. For non existing analog outputs set the appropriate element to zero

Example: Output A, output range 4..20mA, desired range limits at 2.5 and 22 mA

-> Y0Limit[0] = 1'250

-> Y2Limit[O] = 11'000

3. Realization of interface

3.1 Interface confinuration

The bus interface uses the following transmission mode:

- 1 start bit (0), 8 data bits, 1 stop bit (1), no parity
- baudrate 1'200..9'600 baud (programmable via RS-232), presetting 9'600 baud

3.2 Principle of transmission

The transmission is fully controlled by the master (PC). No connected device is allowed to send data without pric request by the master. The master as well monitors possibly occuring timeouts (no response from the addresse device). Messages are transmitted using the RTU (remote terminal unit) mode.

The MODBUS® protocol defines a silent interval of 3,5 characters following the last transmitted character as end c the message. After this interval a new message can be sent. A typical message frame is shown below:

Pause	Message 1	→	*Pause*	Message 2	→	*Pause*	Message 3	etc.

The silent inverval can be prolongated (configured via RS232 interface).

Remark: A prolongation of the minimal silent interval may be necessary if the master is not able to send subsequent characters fast enough and therefore causes a transmission break. This effect may occur a PC with power management is used (especially notebooks). A high baudrate reinforces this effect.

3.3 General mesage frame

address (8 bits)	**function** (8 bits)	**data**	**crc16** (16 bits)

address: Address of the device which should perform an action (query message from master) or which i responding (response message from slave). The allowed address range 1..247.

function: Tells what kind of action to perform. The following function codes are used in communication with the M40:

Code	MODBUS® function	Used for ...
03H	READ HOLDING REGISTERS	- measurand acquistion - meter reading - reading scaling factors - reading measurand table - reading configuration data
10H	PRESET MULTIPLE REGISTERS	- programming the transducer - meter setting - selecting measurands to evaluate - resetting slave pointers

data: Contains the information to transmit. This field is divided into register, number of register to transm and if necessary read data or information to strore. Data is normally transmitted as 16 bit register but there are also 32 bit numbers (double registers) and double bytes used (see chapter 3.5).

crc16: The cyclic redundancy check calculation is performed on the message contents detect transmissio errors.

.4. Cyclic redundancy check calculation (crc16) (example using'C)'

he calculation is perfomed on all message characters, except the check bytes itself. The low-order byte Crc_LByte) is appended to the message first, followed by the high-order byte (Crc_HByte). The receiver of the ıessage calculates the check bytes again and compares them the received ones.

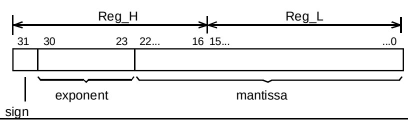
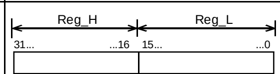
```
void main()
{
   unsigned char data[NUMDATA+2];            // Message buffer
   unsigned char Crc_HByte,LByte;            //
   unsigned int Crc;
   ....
   Crc=0xFFFF;
   for (i=0; i<NUMDATA; i++){
     Crc  =  CRC16 (Crc, data[i] );
    }
   Crc_LByte = (Crc & 0x00FF);              // calculate low-order byte
   Crc_HByte = (Crc & 0x00FF) / 256;        // calculate high-order byte
}
// CRC16 calculation
// ————————
unsigned int CRC16(unsigned int crc, unsigned int data)
{
   const unsigned int Poly16=0xA001;
   unsigned int LSB, i;

   crc = ((crc^data) | 0xFF00) & (crc | 0x00FF);
   for (i=0; i<8; i++)          {
      LSB=(crc & 0x0001);
      crc=crc/2;
      if (LSB)
        crc=crc^Poly16;
   }
   return(crc);
}
```

.5. Special data types

he standare MODBUS protocol uses 16 bit registers for data transmission. To adapt the transducers data tructure and to improve accuracy the following date types are used as well:

32 bit numbers: 32 bit unsigned integers and 32 bit real numbers are transmitted as two consecutive 16 bit registers. The format of the real number corresponds to the format normally used in PCs.

Type	*32 bit real*	*32 bit unsigned integer*
Format		
Calculation	$\text{Value} = (-1)^{sign} * 2^{(exponent-126)} * \frac{mantissa + 2^{23}}{2^{24}}$	

Transmission order:

Reg_H		*Reg_L*	
HByte	LByte	HByte	LByte

Double bytes : In PCs a 16 bit register is stored with the low byte on the lower and the high byte on the higher address. For the purpose of data transmission they will be swapped. Using double bytes two 8 bit characters are combined to a 16 bit register. But in opposition to 16 bit registers double bytes are ***not swapped*** for data transmission.

BYTE Meas [12]

Here the measurands for the analog outputs and the internal meters are defined.

Messgr	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
M 40	**A**	**B**	**C**	**D**	Z_1	Z_2	Z_3	FF_H	FF_H	Z_4	FF_H	FF_H

[0]...[3]: Anolog outputs **[4],[5],[6],[9]:** Internal meters

The measurand for unused outputs is 00_H and FF_H if the output doesn't exists. Normally you have to use the las two numbers of the measurand code in the order sheet, i.e. 12 for 'P', 25 for 'QF1' etc. (see also table 2). There are a few exceptions:

- For meters you have to use the same measurand as for the appropriate analog output, i.e the apparent power o the system 'S' is 29 not 54.
- Measurands for outgoing active power. 48..51
- Measurands for reactive power capacffive: 52..55
- For applications A24, A34 and A44 the measurand 1 (U12 vvith XO=O, X2=Ur) must be changed to 5.

int XA[4][3] (M 40 only)

Here you can define the lower and the upper range limits and if necessary the break points of the measurands which should appear at the analog outputs.

XA[A,B,C,D][XO,XI,X2].

The range of values for XO..X2 is as follows:

10'000	corresponds with	100%	of the rated value of the appropriate measurand
0	corresponds with	0 %	of the rated value of the appropriate measurand
-10'000	corresponds with	-100%	of the rated value of the appropriate measurand
15'291	($3BBB_H$) is the value for XI if no break point is defined		

Examples farXA[ ][ ]: Rated input voltage Ur=100 V (phase-to-phase), rated input current Ir=1A

- Output A, Measurand I_1 (9), linear 0..1 [A]

XA[0][0] = 0 (0 % of the input)
XA[0][1] = 15'291 (no break point, linear)
XA[01[2] = 10'000 (100 % of the input)

- Output B, Measurand U_{1N} (2), linear 40..60 [V], 100 % of the input is 100/ 3=57.74 V

XA[1][0] = 6'928 (69.28 % of the input)
XA[1][1] = 15'291 (no break point, linear)
XA[1][2] =10'391 (103.91 %of the input)

- Output C, Measurand P_1 (13), -50..50 W, break point at 10 W, 100 % of the input is Ur*Ir 3=57.74 W

XA[2][0] = -8'660 (-86.60 % of the input)
XA[2][1] = 1'732 (1 7.32 % of the input, independent of what analog output you got for it)
XA[2][2] = 8'660 (86.60 % of the input)

The programming of frequency measurement is an exception :

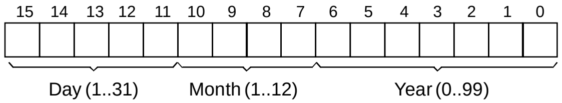
The values are directly in [mHz].

15,3 Hz -> 15,300 [mHz]
65,0 Hz -> 65,000 [mHz]

!!! ATTENTION: Here an 'unsigned int' will be stored in an 'int'.

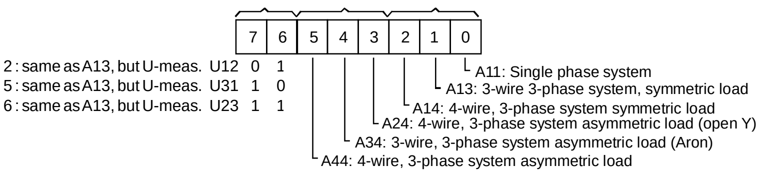
ꞁORD ProgDate

ꞁate of the last configuration of the transducer (informal).



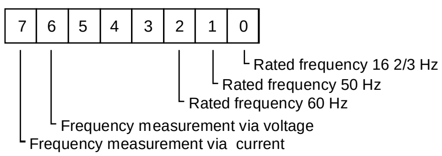
ꞁYTE Application

ꞁontains the application of the transducer. This information allows to derive which measurands in fact can be ꞁaluculted respectively which of them are valid for measurand display (see also chapter 4.2)



ꞁYTE Freqmeas

ꞁefines the rated frequency and the kind of frequency measurand. Frequency is measured via voltage path ꞁormally. If there is no voltage input or in cases of instability frequency measurement can be performed via ꞁurrent path. When programming, rated frequency and calibration frequency should be checked against each ꞁther. They should be the same, otherwise permissible variations will increase.



ꞁORD Ir

ꞁated value of input current. Ir may be 0 (no current input) or 1000...6000 [mA].

ꞁONG PrimaryIr

ꞁefines the primary rated current of a possible current transformer in [A]. If there is no current transformer, this ꞁalue should be zero otherwise maximum 200'000 A.

ꞁORD Ur

ꞁated value of input voltage. You have to store **always** the phase-to-pahse voltage even if you measure in a single ꞁhase system where no phase-to-phase voltage exists. Ur contains the voltage [V]*50, so the allowed range ꞁ 5'000...34'641 (100 ... 692.8V). Without input voltage you can set Ur to zero but you have to switch frequency ꞁeasurement to via current, (see 'Freqmeas').

ꞁONG PrimaryUr

ꞁrimary rated voltage of a possible voltage transformer in [V]. If there is no voltage transformer, this value should ꞁe zero otherwise maximum 2'000'000 V.

4. Measurand acquisition

The transducer maintains a table with all present rneasurands stored as unsealed values. To calculate the rea physically values of the measurands a furthertable contains appropriate scaling factors.

Phys.value = scaling factor .measurand

The scaling factor is constant. The only way to change its value is to change its reference quantity by means o reprogramming the rated values or application (system). If there are primary transformers used their ratings ar included in the scaling factor. So the calculated physically value corresponds always with the primary value.
The MXX supports 47 different measurands. If a measurand is calculable depends on the selected applicatio (system). If i.e. a one phase system is used, the phase-to-phase voltages U12, U23 and U31 cannot b determined, because they don't exist. If you don't need all possible measurands you can switch-off the calculation. By this the measurement cycle is shorter and therefore the response time of the analog outputs a well. The user has to fetch the scaling factors only one time at the beginning of the acquisition and store them fo further use. After that it's sufficient to acquisit the present measurands.

It depends on the number of relevant measurands and the frequency of their interrogation to decide whic way is bestto acquisit rneasurands from the transducer. The user has the choice between two different data sets the 'complete data set' and the 'reduced data set'.

- The *'complete date* set' contains all possible measurands, that means 47 measurands and 47 scalin factors. Its advantage: Every single rneasurand has a unique register number and therefore can b interrogated directly. Its disadvantage: Because there are never all measurands calculated the appropriat tables contain also invalid (non calculated) data. However, ifyou read the complete tables oder large part of register blocks lots of invalid data will be transmitted and therefore increases the amount of data to p transmitted (and the time to transmit them as well).
- The second set is called the *'reduced data set'* and contains measurands and scaling factors of th calculated items only. Its advantage: The tables contains relevant data only which reduces the effort fo data transmission. Its disadvantage: The positions of individual measurands are unknown and have to b evaluated and stored first (but only one time).

The general actions to acquisit measurands from the transducer are the following:

1. Single request for those measurands really calculated
2. Single request for the measurands sealing factors (reduced or complete dataset)
3. Repeated acquisition of present measurands (reduced or complete data set) and evaluation of the physical values.

4.1 Selection of measurands to calculate

Which of the 47 measurands depending on the system are measurable you can see in table 2. As mentione before it's possible to reduce this available selection to speed up the measurement cycle. The transducer has registers containing the information if a measurands will be evaluated (bitset) or not. This information can b read or set. The registers are organized in double bytes (see chapter 3.5). Of course it's impossible to switch o the calculation for a measurand which can't be measured considering the connected system.

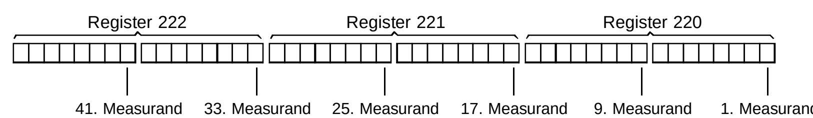


Table 1

Register	Content	Register	Content	Register	Content
220	Measurands 1..8 Measurands 9..16	221	Measurands 17..24 Measurands 25..32	222	Measurands 33..40 Measurands 41..48

lessages for the selection of measurands (example for device 7):

'equest : Reading measurands which are really calculated

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07H	03H	00H	DCH	00H	03H	CRC16	

'evice response:

Device	Code	Number of bytes	Data	Checksum	
				LByte	HByte
07H	03H	06H	6 *Data bytes*	CRC16	

'equest : Setting the measurands to be calculated

Device	Code	Register		Number of registers		Number of bytes	Data	Checksum	
		HByte	LByte	HByte	LByte			LByte	HByte
07H	10H	06H	DCH	00H	03H	06H	6 *Data bytes*	CRC16	

'equest : Reading measurands which are really calculated

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07H	10H	00H	DCH	00H	03H	CRC16	

l.2 Complete data set

The complete data set consists of the lable of the present measurands with 47 registers (16 bit) and the lable of the scaling factors with 47 double registers (32 bit real numbers, see chapter 3.5).

Complete measurand lable : Contains all measurands the transducer is able to calculate. However, only these measurands with the appropriate bit set in table 1 are valid.

Register	Measurand	A11..A16 1-phase	A34 3-wire	A24/A44 4-wire	Register	Measurand	A11..A16 1-phase	A34 3-wire	A24/A44 4-wire
100	1: U	3	-	-	124	25: Qf1	-	-	3
101	2: U1N	-	-	3	125	26: Qf2	-	-	3
102	3: U2N	-	-	3	126	27: QF3	-	-	3
103	4: U3N	-	-	3	127	28: F	3	3	3
104	5: U12	-	3	3	128	29: S	3	3	3
105	6: U23	-	3	3	129	30: S1	-	-	3
106	7: U31	-	3	3	130	31: S2	-	-	3
107	8: I	3	-	-	131	32: S3	-	-	3
108	9: I1	-	3	3	132	33: IM	-	3	3
109	10: I2	-	3	3	133	34: IMS	-	3	3
110	11: I3	-	3	3	134	35: LF	3	3	3
111	12: P	3	3	3	135	36: LF1	-	-	3
112	13: P1	-	-	3	136	37: LF2	-	-	3
113	14: P2	-	-	3	137	38: LF3	-	-	3
114	15: P3	-	-	3	138	39: IB 15min	3	-	-
115	16: Q	3	3	3	139	40: IB1 15min	-	3	3
116	17: Q1	-	-	3	140	41: IB2 15min	-	3	3
117	18: Q2	-	-	3	141	42: IB3 15min	-	3	3
118	19: Q3	-	-	3	142	43: BS 15min	3	-	-
119	20: PF	3	3	3	143	44: BS1 15min	-	3	3
120	21: PF1	-	-	3	144	45: BS2 15min	-	3	3
121	22: PF2	-	-	3	145	46: BS3 15min	-	3	3
122	23: PF3	-	-	3	146	47: UM	-	-	3
123	24: QF	3	3	3					

(**3** = Measurand can be calculated)

7. Configuration of the transducer

By changing the parameters the transducer can be suit to changing conditions. It's possible to change individu registers or multiple contiguous registers at once, However, each step of configuration causes the transducer t send the error message in response to further requests for measurands (see chapter 8). So the user is informe that he has to refresh the previous stored data set of the transducer.

Following each type step changing parameters the transducer starts up to initialize the new configuration. During about 3 seconds the transducer cannot handle communication requests.

(Used data types (C) : BYTE=unsigned char, WORD=unsigned int, LONG=unsigned long)

Information data (not required for device function)

Table 9.1

Register	Type	Variable name		Meaning
700	WORD	Prog date	❶	Date of last configuration
701	BYTE	Application		Connected system
	BYTE	Freqmeas		Frequency measurement U/I, rated frequency
702	WORD	Ir		Rated current [mA]
703	LONG	Primary		Primary rated value of input current transformer [A
705	WORD	Ur		Rated voltage
706	LONG	Primary Ur		Primary rated value of input voltage transformer [V
708	BYTE	Meas [12]		Measurands (used: 0..6 and 9)
714	int	XA[4][3]	❷	Characterstic of analog measurands : X0;X1;X2
726	int	YA[4][3]	❷	Chercterstic of analog outputs:YO;Y1;Y2 software
738	WORD	Ydel[12]	❷	Response time of measurnads
750	WORD	Not used 1[22]		Not used for M40
772	int	YOLimit[4]	❷	Lower range limit of analog outputs
776	int	Y2Limit[4]	❷	Upper range limit of analog outputs
780	char	Fileinfo[94]	❶	User defined text for device description

Table 9.2 (status:'read only', to be used for verification purpose only

Register	Type	Variable name		Meaning
600	BYTE	Outp Type [4]	❷	HW-Info : type of analog outputs
602	WORD	Y2HW [4]	❷	hardware range limits of analog outputs
606	BYTE	Device Type	❶	device type (constant)
	BYTE	CalFreq	❶	calibration frequency
607	char	Password [8]	❶	User defined password
611	char	passw Validity	❶	Validity of password protection
	BYTE	CalVers	❶	Calibration version
612	BYTE	EPROMVers (2)	❶	EPROM VERSION, [0]=high_byte, [1] = low_byte

Password protection : A possible defined password and its validity represent a protection mechanism agains unpermitted modification of transducer data which is used in the standard software c MXX for programming via RS232 interface. If you use this protection mechanism for th bus interface as well depends on your own requirements.

ATTENTION :

The individual parameters have to match with each other. So i.e. If you want to change the application (systen you have to check if all the configured measurands for the analog outputs are still measurable. If you perform non balanced configuration the transducer may not work correctly.

. Resetting salve pointers

. maximum of four slave pointers can be defined for the analog outputs A to D (DME440 only) and for the bus ıeasurands 43..46 (with fixed response time of 15 min.). They can be resetted by setting the appropriate bit(s) ir e following register.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0					0	0	0	0				
				BS3	BS2	BS1	BS					D	C	B	A

able 8

Register	Content
230	slave pointers reset

fter executing the reset the transducer will initialize the register to all zeroes again.

lessages for resetting slave pointers(examples for device 7):

- *Request: Reset salve pointer of analog output B*

Device	Code	Register		Number of registers		Number of bytes	Daten	Checksum	
		HByte	LByte	HByte	LByte			LByte	HByte
07H	10H	00H	E6H	00H	01H	02H	00H, 02H	CRC16	

Device response:

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07H	10H	00H	E6H	00H	01H	CRC16	

The range of values for the present measurands is as follows:

10'000	corresponds with	100%	of the rated value of the appropriate measurand
0	corresponds with	0%	of the rated value of the appropriate measurand
-10,000	corresponds with	-100%	of the rated value of the appropriate measurand

Exception: The frequency is directly stored in [mHz]. The appropriate range of values is 15'300...65'000

Complete scaling table: The order is the same as for the measurands (but uses 2 registers for each factor)

Table 3 (status: 'read only')

Register	Measurand	Register	Measurand	Register	Measurand
300	1: U	**332**	17: Q1	**364**	33: IM
302	2: U1N	**334**	18: Q2	**366**	34: IMS
304	3: U2N	**336**	19: Q3	**368**	35: LF
306	4: U3N	**338**	20: PF	**370**	36: LF1
308	5: U12	**340**	21: PF1	**372**	37: LF2
310	6: U23	**342**	22: PF2	**374**	38: LF3
312	7: U31	**344**	23: PF3	**376**	39: IB 15 min
314	8: I	**346**	24: QF	**378**	40: IB1 15 min
316	9: I1	**348**	25: QF1	**380**	41: IB2 15 min
318	10: I2	**350**	26: QF2	**382**	42: IB3 15 min
320	11: I3	**352**	27: QF3	**384**	43: BS 15 min
322	12: P	**354**	28: F	**386**	44: BS1 15 min
324	13: P1	**356**	29: S	**388**	45: BS2 15 min
326	14: P2	**358**	30: S1	**390**	46: BS3 15 min
328	15: P3	**360**	31: S2	**392**	47: UM
330	16: Q	**362**	32: S3		

Messages for the measurands acquistion (examples for device 7):

- *Request: Complete scaling table*

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07H	03H	01H	2CH	00H	5EH	CRC16	

Device response:

Device	Code	Number of bytes	Data	Checksum	
				LByte	HByte
07H	03H	BCH	188 *bytes*	CRC16	

*The 'Number of registers' corresponds to the number of factors to read *2, because register is always a 16 bit value but the scaling factors are 32 bit real numbers The 'Number of bytes' is the same as the number of requested registers *2. Format and sequence of transmission of the real numbers see chapter 3.5*

- *Request: Single measurand 'P' from table 2*

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07H	03H	00H	6FH	00H	01H	CRC16	

Device response:

Device	Code	Number of bytes	Data		Checksum	
			HByte	LByte	LByte	HByte
07H	03H	02H	27H	10H	CRC16	

The received measurand in this example is 10'000 (2710H). For conversion to physical value it has to be multiplied with th appropriate scaling factor (register 322 and 323).

.3 Reduced data set

he reduced data set consists of the table extracts of the present measurands (16 bit interger) and the scalinc ictors (32 bit real numbers, see chapter 3.5).

he sequence of measurands and factors is the same as seen for the complete data set but all values which aven't been calculated are removed. To determine how many registers have to be read you just have to count ie number of bits set in table 1 (calculated measurands).

able 4 (status: 'read only')

Register	Content
150..	All calculated measurands

able 5 (status: 'read only')

Register	Content
400..	Scaling factors for all calculated measurands

estriction: The tables have to be read starting at register address 150 or 400 respectively. However, the number f registers you read don't have to correspond with the number of really existing registers.

lessages for measurands acquisition (examples for device 7):

- Request: Scaling factors for all calculated measurands, table 5:

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07_H	03_H	01_H	90_H	00_H	10_H	CRC16	

Device response:

Device	Code	Number of bytes	Data	Checksum	
				LByte	HByte
07_H	03_H	20_H	32 *bytes*	CRC16	

This example shows the interogation of the scaling factors of 8 measurands. It assumes that the number of really calculated measurands (chapter 4.1) has 8 bits set in the table.

- Request: Measurands of all calculated measurands, table 4

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07_H	03_H	00_H	96_H	00_H	08_H	CRC16	

Device response:

Device	Code	Number of bytes	Data	Checksum	
				LByte	HByte
07_H	03_H	10_H	16 *bytes*	CRC16	

This example shows the acquisition of 8 measurands.

TTENTION:

' the transducer has been reconfigured (or switched on) every further request for measurands will be nswered with the error message '0A H' (see chapter 8). This way the user will be informed that he has) update the data set he has previously stored of the addressed transducer. To release the ıeasurand acquisition you have to read the table of measurands to be evaluated (table 1) and the scaling ictors table (again).

5. Meter reading

Up to four internal counters can be configured at the same time. The meter readings are stored as unsigned 32 b integers. For every meter there is also a scaling factor available (32 bit real number), although the present mete readings are already scaled in the basic units [Wh, Varh, Vah, mAh]. The factors just represent the scaling fror secondary to primary values if transformers are used. 32 bit numbers, see chapter 3.5.

Table 6

Register	Content	Register	Content
200	Internal meter 1	204	Internal meter 3
202	Internal meter 2	206	Internal meter 4

Table 7 (status: 'read only')

Register	Content	Register	Content
500	Scaling for meter 1	504	Scaling for meter 3
502	Scaling for meter 2	506	Scaling for meter 4

Messages for meter reading (examples for device 7):

- Request: Scaling factors for meters

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07_H	03_H	01_H	$F4_H$	00_H	08_H	CRC16	

Device response:

Device	Code	Number of bytes	Data	Checksum	
				LByte	HByte
07_H	03_H	10_H	16 data *bytes*	CRC16	

- Request: Present meter readings

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07_H	03_H	00_H	$C8_H$	00_H	08_H	CRC16	

Device response:

Device	Code	Number of bytes	Data	Checksum	
				LByte	HByte
07_H	03_H	10_H	16 data *bytes*	CRC16	

Messages for meter settings (examples for device 7)

To set a meter to a specific content you possibly have to convert this value from primary to secondary first. You just have to divide the primary value by the scaling factor to achieve the result.

- Request: Setting meter 1 to a specific value

Device	Code	Register		Number of registers		Number of bytes	Data	Checksum	
		HByte	LByte	HByte	LByte			LByte	HByte
07_H	10_H	00_H	$C8_H$	00_H	02_H	04_H	4 data *bytes*	CRC16	

Device response:

Device	Code	Register		Number of registers		Checksum	
		HByte	LByte	HByte	LByte	LByte	HByte
07_H	10_H	00_H	$C8_H$	00_H	02_H	CRC16	