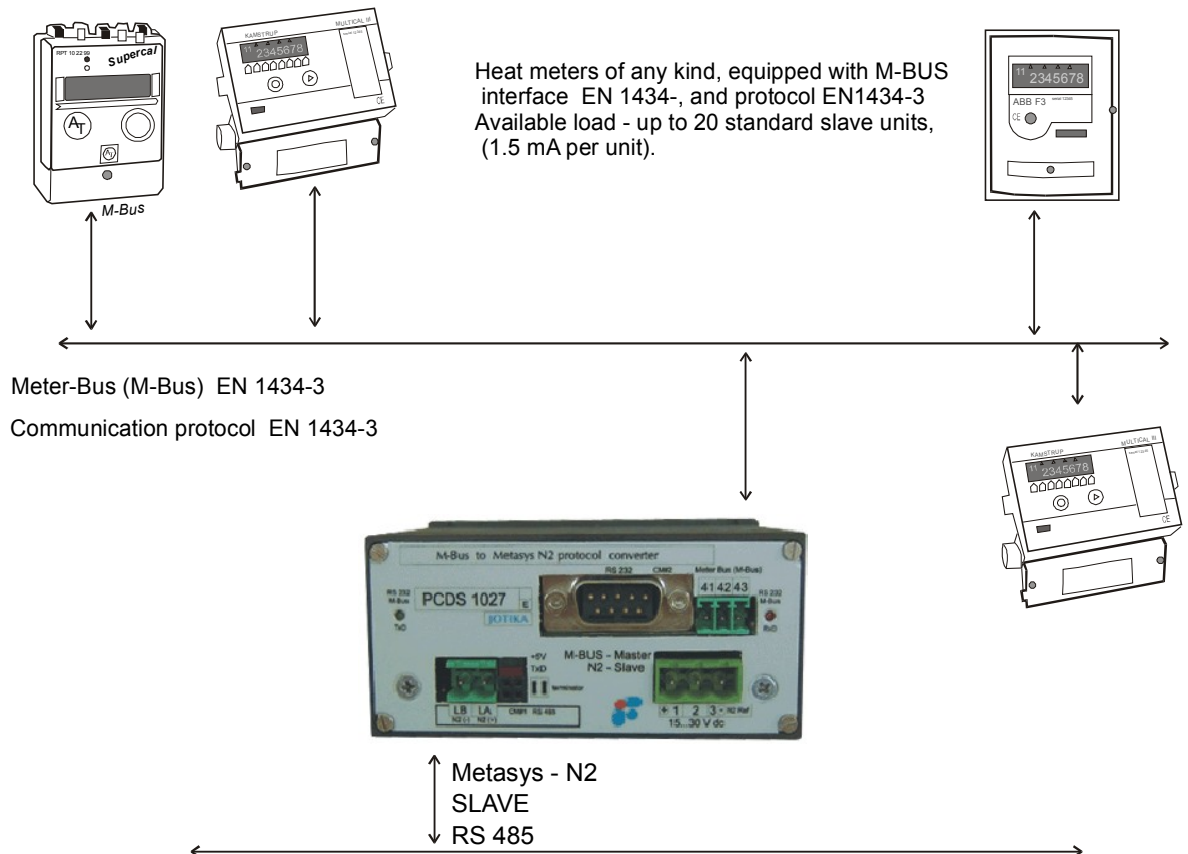




Heat Meter Protocol Converting Device

PCDS 1027 v1.0

PCDS1027 converts data from M-BUS protocol, used by the most kind of heat meters, to the Johnson Controls Metasys N2 protocol.





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1. Reference

Document refers to PCDS1027, firmware M-BUS>N2 (version from 2005.08.24) and application cemp06.exe version 1.0.0.0.

2. Functions

Device consists of two functional modules, electrically separated to each other. The first one (on the bottom) with the rs485 port (CM#1) and the power connector on board. The second (on the top) is equipped with rs232 and M-BUS connectors.



The rs485 port is intended to connect converter to the N2 interface as a slave device. The rs232 and M-Bus connectors are on the heat meters network side. They actually work in parallel and act functionally as one port CM#2. Up to 20 standard (1.5mA load) M-BUS slaves can be connect to PCDS1027. Scheme below presents the functional structure of the device.

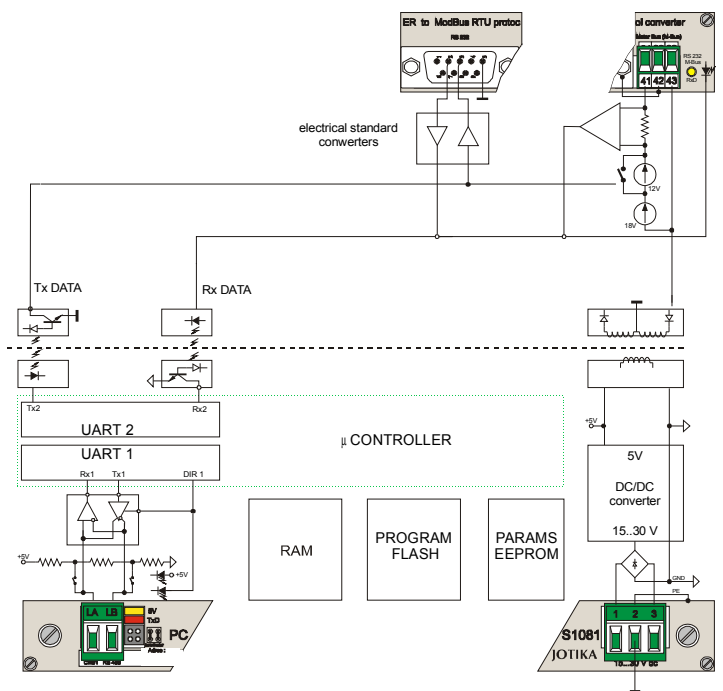
Working scheme:

Converter as a M-Bus master, periodically communicates to the M-Bus slaves, according to the device list stored in flash memory. The list is programmed by user with a special configuration program cemp06.exe.

Data acquired from slaves are converted to the standard format and loaded to memory records, that are available through rs485 port and N2 protocol.

Time period can be programmed independently for each M-BUS slave.

PCDS1027 behaves, on side of N2 protocol, as a number of N2 slaves, with its own address each.





3. Connectors and connection drawings


Power supply (3-pin connector, 5 mm):

1	U1	Power line (+ 24 V DC)
2	E	Protective grounding Electrically connected to the device case, DB9 (rs232) shield and pin no 42 of M-Bus connector (symmetry network).
3	U2	Power line (0 V)

Port 1 (Com #1) (2-pin connector 5 mm):

LA	N2(+)	Interface RS 485 line RxTx + (positive)
LB	N2(-)	Interface RS 485 line RxTx - (negative)

Terminator (connector (4-pin female), 2.5 mm):

	12 34	1- LA ;2-LB; 3-R120 ohm(2.7kohm to +5V); 4-R120 ohm(2.7kohm to GND) Connect (1-3) & (2-4) to apply embedded terminator to the lines LA;LB;
---	----------	---

Heat meters side:

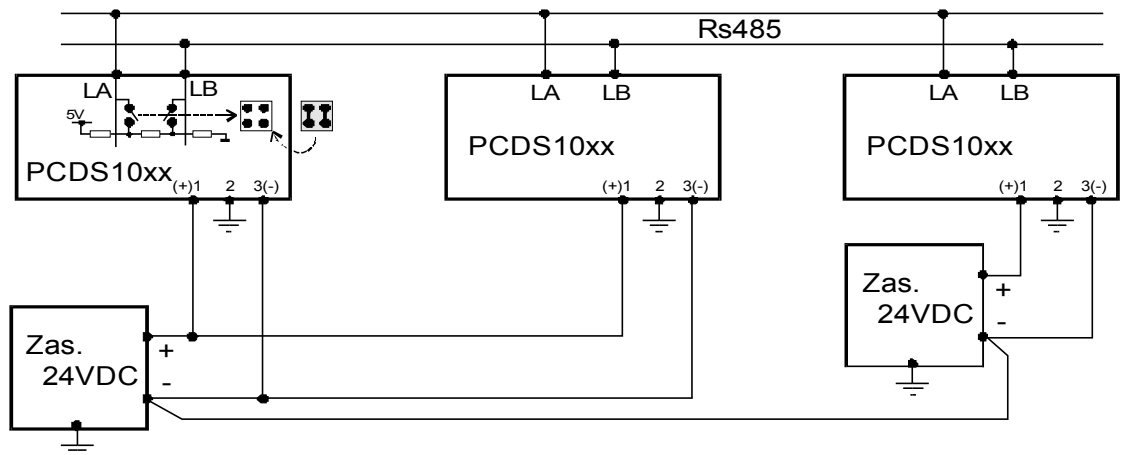
Port 23 RS232 (9-pin DB9 male):

1	nc	
2	RxD	Received data (data from heat meter)
3	TxD	Transmitted data (data to heat meter)
4		+12V (3 mA max.) via 10 ohm
5	GND	Ground. Connected to 0V
6	nc	
7	Joined to 8	
8	Joined to 7	
9	nc	

Port 24 M-BUS (3-pin connector, 3.5 mm): METER BUS EN 1434-3 - interface

41	M-BUS1	Data line
42	PE	Symmetrical network ground point Electrically connected to the device case, DB9 (rs232) shield and pin no 2 of power supply connector. It's not connected to any other internal circuit.
43	M_BUS2	Data line

Power supply and RS485 connections drawings



NOTE! A common ground potential is necessary for proper RS485 interface operating. For PCDS10XX it's a pin no 3 (0V) of power supply connector. Some third party equipment use PE as a common potential. In that case pin 3 of power supply connector should be joined to the pin 2.



Indicators (LED)

Symbol	Colour/shape	Function
5V	Green/rect	Power supply (+5V)
TxD	Red/rect	Rs485 - Transmitter activity(on - during reset)
TxD	Green/circ	M-BUS – Transmitter activity
RxD	Red/circ	M-BUS – Receiver activity

4. Technical specification

Port #1	RS 485 ; 300...19200 bps N2 SLAVE,	
Port #2	<ul style="list-style-type: none"> • Rs232, M-Bus (Meter Bus) • 2 connectors, one functional channel • Electrically separated from Port #1 	
Power Suppl.	18...30 V DC // 60...80 mA	
Fastening:	Rail mount: TS35 (vertically or horizontally) 	
Available protocols	EN 1434-3 M-Bus via port no 23, 24 (rs232 , M-BUS) (M-Bus; SND-NKE, SND-UD2) Metasys N2 via port no 1 (rs485)	

5. Heat Meters Network Configuration

Heat meters can be connected to the converter through P23 and P24 connectors.

P24 is intended for direct connecting of M-Bus standard devices. It's possible to connect up to 20 standard M-Bus slaves simultaneously.

M-Bus compatible device equipped with rs232 interface, can be connected to the converter via P23. The P23 can be used to indirect connecting heat meters via M-Bus/rs232 concentrating device.

Note! Data sent from converter appear on both port transmitters at a time. Therefore addressing area of both networks is common.

6. Data record

Data read from meter is converted and loaded to memory records. Each heat meter in network is connected to the one uniform memory record – virtual N2 slave device.



Each of that virtual device provides two groups of data (regions): analog inputs (AI) and binary inputs (BI).

The address map of virtual N2 device is presented in Table 6.1.

Tabela 6.1.

Parameter	Inputs	Description	Notes
IDNUM	AI-1,AI-2	Identification number	*1
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number (increments for each RSP)	
P1	AI-10,AI-11	Heat meter data no 1	*2
P2	AI-12,AI-13	Heat meter data no 2	
...	
P30	AI-68,AI-69	Heat meter data no 30	
Unit 1	AI-70	Units, data no 1	*3
Unit 2	AI-71	Units, data no 2	
...	
Unit 30	AI-99	Units, data no 30	
Status B1	BI-1	Heat meter status - reserved	*4
Status B2	BI-2	Heat meter status - reserved	
Status B3	BI-3	Heat meter status – power low	
Status B4	BI-4	Heat meter status – permanent error	
Status B5	BI-5	Heat meter status – temporary error	
Status B6	BI-6	Heat meter status – manufacturer specified	
Status B7	BI-7	Heat meter status - manufacturer specified	
Status B8	BI-8	Heat meter status - manufacturer specified	
ConvErr B1	BI-9	Conversion status – time out	*5
ConvErr B2	BI-10	Conversion status – response error	
ConvErr B3	BI-11	Conversion status – CRC error	

Notes!

- *1 Data format in AI area is IEEE floating point, single precision. Double precision numbers are represented by two consecutive AI (AI-1,AI-2) and should be decoded as follows: $X = AI-1 * 1000000 + AI-2$.
- *2 Parameters P1 .. P30 are data items that appear one by one in variable part of M-BUS telegram. Structures of M-BUS telegram are published by most of manufacturers.
- *3 Unit codes (1..30) refers to the parameters P1..P30. See table 7.1.
- *4 Heat meters status bits are defined in EN 1434-3.
- *5 Conversion status describes status of communication between device and heat meter..

In N2 protocol data from AI and BI are provided with additional status info and indicator of its reliability. Value is reliable if it has been properly read from heat meter. Whole variables are unreliable after power on and restart of device. If there are errors in transmission between device and heat meter, all variables of the virtual device get unreliable status.

7. Units coding table

Units of parameters read from heat meters are encoded according to the below table:

Table 7.1



Units	code	Units	code	Units	code	Units	code
date	0	MJx100	16	MJ/h	32	ml/hx10	48
date&time	1	GJ	17	MJ/hx10	33	ml/hx100	49
Wh	2	GJx10	18	MJ/hx100	34	l/h	50
Whx10	3	GJx100	19	GJ/h	35	l/hx10	51
Whx100	4	W	20	GJ/hx10	36	l/hx100	52
kWh	5	Wx10	21	GJ/hx100	37	m ³ /h	53
kWhx10	6	Wx100	22	ml	38	m ³ /hx10	54
kWhx100	7	kW	23	mlx10	39	m ³ /hx100	55
MWh	8	kWx10	24	mlx100	40	°Cx10 ⁻³	56
MWhx10	9	kWx100	25	l	41	°Cx10 ⁻²	57
MWhx100	10	MW	26	lx10	42	°Cx10 ⁻¹	58
kJ	11	MWx10	27	lx100	43	°C	59
kJx10	12	MWx100	28	m ³	44	seconds	60
kJx100	13	kJ/h	29	m ³ x10	45	minutes	61
MJ	14	kJ/hx10	30	m ³ x100	46	hours	62
MJx10	15	kJ/hx100	31	ml/h	47	days	63



Date & time coding

	Bits	Meaning
date (code=0)	B4..B0	Day (1..31)
	B11..B8	Month (1..12)
	B15..B12, B7..B5	Year (0..99)

	Bits	Meaning
Date&time (code=1)	B5..B0	Minutes (0..59)
	B12..B8	Hours (0..24)
	B20..B16	Day (1..31)
	B27..B24	Month (1..12)
	B31..B28, B23..B21	Year (0..99)

To decode date or date and time from double precision number, two subsequent readings must be done and then 32-bit variable defined as $X = A1 * 1000000 + A2$ can be decoded according to tables above.

8. Conversion control

Functionality of the device is defined by user in configuration process. The configuration data consist of records that define virtual devices (VD). Each VD refers to heat meter connected to M-BUS interface. The configuration list is located in non volatile flash memory.

Structure of data record is defined below:

Table 8.1

Pos.	Description
1	Interface of heat meter (M-BUS, RS232)
2	Heat meter type (Standard, Infocal, Multical, Supercal itd.)
3	M-BUS address of heat meter
4	Polling cycle [min]
5	Address of VD in N2 protocol
6	FCB bit behavior in M-BUS query
7	Idle time between subsequent transmissions to the meter
8	Forcing Normalization (SND_NKE) before request for data (REQ_UD2)
9	Communication parameters (baud rate, parity)



9. Default settings of selected heat meters

Device	Data Record	FCB	Baud rate [bps]	Parity	Pause between transmissions:
Multical	Multical	1	300 2400	even	> 9 sec.
INFOCAL 5	Infocal	toggled	300 600 1200 2400	even	Not defined (0)
SVM F3	F3	1	300 2400	even	Not defined (0)
LEC4 D	LEC	1	2400	even	Not defined (0)
SUPERCAL	Supercal	1	2400	even	Not defined (0)
LQM II K	LQM	1	300 1200 2400 9600	even	Not defined (0)



10. Installation notes

1. PCDS1025N is designated to work as a part of measurement and automation systems. It should be installed by professional integrators.
2. PCDS1025N should be installed on TS35 rail, possibly inside the metal, grounded case, far from strong magnetic fields and electro-magnetic radiation sources.
3. Device doesn't need special maintenance. It's recommended to keep all necessary precautions against damages from static discharges.
4. Device should be powered by 24 V DC supplier, possibly mounted inside the same case.
5. Devices connected to the common rs485 network have to be all connected to the common zero potential.
6. Connection cable to the rs-232 device (if exists) should be no longer than 3 m.
7. Internal circuits of rs485 and M-BUS interfaces are protected from short-circuits by electronic fuses. If activated they need some time to cool down.
8. Signal cables should be shielded.
9. It's recommended to connect pin no 2 of the device power supply connector to the protective grounding.

11. M-BUS specification

Functionality:

Two kinds of query can be sent from the device:

- SND_NKE (40) - Normalization (if defined in configuration record)
- REQ_UD2 (5B/7B) - Request for data

Electrical specification :

Electrically separated M-BUS interface.

<i>Parameter</i>	<i>PCDS1027E</i>	<i>Description</i>
N	20	Max number of connected slaves
$U_{MU,M(1)}$	31.3 V	Level MARK under minimal load (1 slave).
$U_{MU,M(max)}$	29.3 V	Level MARK under maximal load (N slaves).
$U_{MU,S(1)}$	20.3 V	Level SPACE under minimal load (1 slave).
$U_{MU,S(max)}$	18,3 V	Level SPACE under maximal load (N slaves).



12. N2 specification

Functionality:

Device can answer followed N2 queries:

<i>Query</i>	<i>Response</i>	<i>Notes</i>
Identify Device Type (F)	A10<CS><CR>	From restart until receiving this query, all other queries are responded with N00<CR>.
Time Update (0/0)	A<CR>	
Read Memory (0/1)	N01<CR>	Not serviced
Poll Message (0/4, 0/5)	A<CR>	Device doesn't respond on polling.
Warm Start (0/8)	N01<CR>	Not serviced
Status Update (0/9)	N01 <CR>	Not serviced
Read AI (1/1XX01)	A00<CS><CR>	In response of query about "Object Configuration" of analog input XX value 00 is sent
Read AI (1/1XX02-03)	ASSYYYYYYY<CS><CR>	In response of query about parameter no 2 or 3 both parameters are sent: SS (Object status) is 00 if value is reliable or 01 if not (not read), Y..Y – value from input XX as floating point number
Read AI (1/1XX08-12)	A00FFFFFFFF<CS><CR>	In response of query about parameter no 8-12 value INVALID_FLOAT is sent
Read BI (1/2XX01)	A00<CS><CR>	In response of query about "Object Configuration" of binary input XX value 00 is sent.
Read BI (1/2XX02)	ASS<CS><CR>	Parameter SS of response has on bit B0 reliability information (00 – reliable, 01 – not reliable), on bit B6 variable value (00 – Low, 40 – High)
Write Field (2/x)	N10<CR>	Not supported
Override (7/2,7/3)	N10<CR>	Not supported
Upload (8/0-4)	N01<CR>	Not supported
Download (9/0-4)	N01<CR>	Not supported

Electrical specification :

RS485 interface port is protected against over voltage and short circuit (fuses on both lines).

Transmitter load: 32 unit loads (UL).

Internal line terminal resistance 200 ohm and inputs polarization, activated with external connector on device front panel (see p.3).



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Appendix – Predefined records

1. INFOCAL 5 (DANFOSS)

Parameter	Input	Description	Notes
IDNUM	AI-1,AI-2	Identification number	
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version Number	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number (increments for each RSP)	
Custom No	AI-10,AI-11	Customer No	
Energy	AI-12,AI-13	Energy Total	
Volume	AI-14,AI-15	Volume Total	
Power	AI-16,AI-17	Power	
Volume Flow	AI-18,AI-19	Flow	
FWTemperature	AI-20,AI-21	Flow Temperature	
RVTemperature	AI-22,AI-23	Return Temperature	
DeltaT	AI-24,AI-25	Temperature Difference	
OnTimeHours	AI-26,AI-27		
Date&Time	AI-28,AI-29		
ErrorCodeOnDisp.	AI-31		*1
Units	AI-70..AI-80	Units	
ConvErr B1	BI-9	Conversion status– time out	
ConvErr B2	BI-10	Conversion status – response error	
ConvErr B3	BI-11	Conversion status – CRC error	

*1 Error code on display:

B0 Error on Forward temperature for more than 1 hour
 B1 Error on Reverse temperature for more than 1 hour
 B2 Internal EEPROM error
 B3 Difference temperature but no flow for more than 48 hours
 B4 Overflow error. Flow 1 input > Qsmax



2. SVM-F3 (ABB)

Parameter	Input	Description	Notes
IDNUM	AI-1,AI-2	Identification number	
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version Number	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number (increments for each RSP)	
Energy	AI-10,AI-11	Energy Total	
Volume from wm	AI-12,AI-13	Volume from water meter	
Volume	AI-14,AI-15	Volume total	
FWTemperature	AI-16,AI-17	Flow Temperature	
RVTemperature	AI-18,AI-19	Return Temperature	
DeltaT	AI-20,AI-21	Temperature Difference	
OnTimeHours	AI-22,AI-23		
Oper.Time	AI-24,AI-25		
Volume Flow	AI-26,AI-27		
Power	AI-28,AI-29		
Date&Time	AI-30,AI-31		
PulsCounter1	AI-32,AI-33		
PulsCounter2	AI-34,AI-35		
Units	AI-70..AI-82	Units	
Status B1	BI-1	Heat meter status - reserved	*1
Status B2	BI-2	Heat meter status - reserved	
Status B3	BI-3	Heat meter status – power low	
Status B4	BI-4	Heat meter status – permanent error	
Status B5	BI-5	Heat meter status – temporary error	
Status B6	BI-6	Heat meter status – temp. sensor	
Status B7	BI-7	Heat meter status – flow sensor	
Status B8	BI-8	Heat meter status - EEprom	
ConvErr B1	BI-9	Conversion status – time out	
ConvErr B2	BI-10	Conversion status – response error	
ConvErr B3	BI-11	Conversion status – CRC error	

*1 Error code:

- B5+B7 - Alarm
- B7 - Under flow
- B5+B6 - Temperature sensor error
- B4+B8 - EEPROM error
- B4 - Battery exhaustion



3. MULTICAL (KAMSTRUP)

Parameter	Input	Description	Notes
IDNUM	AI-1,AI-2	Identification number	
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version Number	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number (increments for each RSP)	
Energy	AI-10,AI-11	Energy Total	
Water	AI-12,AI-13	Volume Total	
OnTimeHours	AI-14,AI-15		
FWTemperature	AI-16,AI-17	Flow Temperature	
RVTemperature	AI-18,AI-19	Return Temperature	
DeltaT	AI-20,AI-21	Temperature Difference	
Power	AI-22,AI-23		
Volume Flow	AI-24,AI-25		
Energy read	AI-26,AI-27		
Water read	AI-28,AI-29		
Data read	AI-30,AI-31		
Units	AI-70..AI-80		
Status B1	BI-1	Heat meter - reserved	
Status B2	BI-2	Heat meter- reserved	
Status B3	BI-3	Heat meter – power low	
Status B4	BI-4	Heat meter – permanent error	
Status B5	BI-5	Heat meter – temporary error	
Status B6	BI-6	Heat meter – tempsensor	
Status B7	BI-7	Heat meter – flow sensor	
Status B8	BI-8	Heat meter - EEprom	
ConvErr B1	BI-9	Conversion status – time out	
ConvErr B2	BI-10	Conversion status – response error	
ConvErr B3	BI-11	Conversion status – CRC error	



4. LEC 4D (KFAP)

Parameter	Input	Description	Notes
IDNUM	AI-1,AI-2	Identification number	
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version Number	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number (increments for each RSP)	
Energy	AI-10,AI-11	Energy Total	
Water	AI-12,AI-13	Volume Total	
Power	AI-14,AI-15		
Volume Flow	AI-16,AI-17		
FWTemperature	AI-18,AI-19	Flow Temperature	
RVTemperature	AI-20,AI-21	Return Temperature	
Energy overheat	AI-22,AI-23		
Water read	AI-24,AI-25		
Water read	AI-26,AI-27		
Units	AI-70..AI-78		
Status B1	BI-1	Heat meter status - reserved	
Status B2	BI-2	Heat meter status - reserved	
Status B3	BI-3	Heat meter status – power low	
Status B4	BI-4	Heat meter status – permanent error	
Status B5	BI-5	Heat meter status – temporary error	
Status B6	BI-6	Heat meter status – tempsensor	
Status B7	BI-7	Heat meter status – flow sensor	
Status B8	BI-8	Heat meter status - EEprom	
ConvErr B1	BI-9	Conversion status – time out	
ConvErr B2	BI-10	Conversion status – response error	
ConvErr B3	BI-11	Conversion status – CRC error	



5. LQM II K (APATOR)

Parameter	Input	Description	Notes
IDNUM	AI-1,AI-2	Identification number	
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version Number	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number	
Data Read	AI-10,AI-11		
Energy	AI-12,AI-13	Energy Total	
Energy overheat	AI-14,AI-15	Overheat Energy Total	
Volume	AI-16,AI-17	Volume Total	
Volume 4	AI-18,AI-19		
Volume flow	AI-20,AI-21		
Power	AI-22,AI-23		
FWTemperature	AI-24,AI-25	Flow Temperature	
RVTemperature	AI-26,AI-27	Return Temperature	
Run Time	AI-28,AI-29		
Err Time	AI-30,AI-31		
Volume 1	AI-32,AI-33		
Volume 2	AI-34,AI-35		
Volume 3	AI-36,AI-37		
Max Flow	AI-38,AI-39		
Max Power	AI-40,AI41		
Aver FWTemp.	AI42,AI43	Average Flow Temperature	
Aver FVTemp.	AI-44,AI-45	Average Return Temperature	
AverFlow	AI-46,AI-47	Average Flow	
Units	AI-70..AI-88		
Status B1	BI-1	Heat meter status - reserved	
Status B2	BI-2	Heat meter status - reserved	
Status B3	BI-3	Heat meter status – power low	
Status B4	BI-4	Heat meter status – permanent error	
Status B5	BI-5	Heat meter status – temporary error	
Status B6	BI-6	Heat meter status – tempsensor	
Status B7	BI-7	Heat meter status – flow sensor	
Status B8	BI-8	Heat meter status - EEprom	
ConvErr B1	BI-9	Conversion status – time out	
ConvErr B2	BI-10	Conversion status - response error	
ConvErr B3	BI-11	Conversion status – CRC error	



6. KW-1 (APATOR)

Parameter	Input	Description	Notes
IDNUM	AI-1,AI-2	Identification number	
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version Number	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number	
Timer 1	AI-10,AI-11	Working Time	
Timer 1	AI-12,AI-13	Error Time	
Volume 1	AI-14,AI-15		
Volume 2	AI-16,AI-17		
Volume 3	AI-18,AI-19		
Volume 4	AI-20,AI-21		
Volume 5	AI-22,AI-23		
Volume 6	AI-24,AI-25		
Volume 7	AI-26,AI-27		
Volume 8	AI-28,AI-29		
Volume 9	AI-30,AI-31		
Volume 10	AI-32,AI-33		
Volume 11	AI-34,AI-35		
Volume 12	AI-36,AI-37		
Volume 13	AI-38,AI-39		
Volume 14	AI-40,AI41		
Volume 15	AI42,AI43		
Volume 16	AI-44,AI-45		
Units	AI-70..AI-87		
Status B1	BI-1	Heat meter status - reserved	
Status B2	BI-2	Heat meter status - reserved	
Status B3	BI-3	Heat meter status – power low	
Status B4	BI-4	Heat meter status – permanent error	
Status B5	BI-5	Heat meter status – temporary error	
Status B6	BI-6	Heat meter status – tempsensor	
Status B7	BI-7	Heat meter status – flow sensor	
Status B8	BI-8	Heat meter status - EEprom	
ConvErr B1	BI-9	Conversion status – time out	
ConvErr B2	BI-10	Conversion status – response error	
ConvErr B3	BI-11	Conversion status – CRC error	



7. SUPERCAL 432

Parameter	Input	Description	Notes
IDNUM	AI-1,AI-2	Identification number	
Manufr.	AI-3	Manufacturer code	
Version	AI-4	Version Number	
Medium	AI-5	Measured Media: 0 - outlet, 1 - inlet	
Access No	AI-6	Access number	
FWTemperature	AI-10,AI-11	Flow Temperature	
RVTemperature	AI-12,AI-13	Return Temperature	
Power	AI-14,AI-15		
Volume flow	AI-16,AI-17		
Energy	AI-18,AI-19	Energy Total	
Volume	AI-20,AI-21	Volume Total	
On Time	AI-22,AI-23	Working Time	
Data & Time	AI-24,AI-25		
Volume 1	AI-26,AI-27		
Volume 2	AI-28,AI-29		
Model	AI-30,AI-31		
Err code	AI-32,AI-33		
Units	AI-70..AI-81		
Status B1	BI-1	Heat meter status - reserved	
Status B2	BI-2	Heat meter status - reserved	
Status B3	BI-3	Heat meter status – power low	
Status B4	BI-4	Heat meter status – permanent error	
Status B5	BI-5	Heat meter status – temporary error	
Status B6	BI-6	Heat meter status – tempsensor	
Status B7	BI-7	Heat meter status – flow sensor	
Status B8	BI-8	Heat meter status - EEprom	
ConvErr B1	BI-9	Conversion status – time out	
ConvErr B2	BI-10	Conversion status – response error	
ConvErr B3	BI-11	Conversion status – CRC error	