

AK50

PROCESS MOISTURE LOGGER FOR ON- LINE USE IN INDUSTRY

User's Manual for

Profibus DP Fieldbus

AK50 and Its Derivatives

Fully supported by V2.0S and later

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NOTE: The Profibus DP interface configuration has been changed starting from internal SW V0.60DP and later. The old configuration was 4 bytes input/4 bytes output and the new configuration is 16 bytes input/16 bytes output. All the old commands are still valid as such and their parameters are placed in the IO array at the same positions. The extended command set in V0.60DP will use the other array positions 4...15 as well for passing information in/out. Starting from V0.71DP the last byte in the input array bi16 always returns the slave status value and the byte before that, bi15, always returns the optional command identifier which is sent by the master. If your meter's embedded software is of an older version, it does not support these new features nor any of the extended commands. Please, contact Visilab to upgrade your meter's software at a low cost. You will get all the other new features in the meter as well.

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List of Commands Available via Profibus DP

General Commands (decimal and hexadecimal values)

	<i>decimal</i>	<i>hex</i>

Get the General System Status I7GSTATUS	76	0x4C
Get the Second System Status I7G2STATUS	86	0x56
Get the Third System Status I7G3STATUS	89	0x59
Read the Filter Characteristics I7GFILTER	50	0x32
Change the Filter Characteristics I7SFILTER	49	0x31
Get the Locking Status I7GETLOCK	53	0x35
Set the Locking I7GAINLOCK	51	0x33
Set the Autoranging I7GAINOPEN	52	0x34
Get the Lamp Status I7GLAMP	74	0x4A
Get the Chopper Speed I7GFREQ	60	0x3C
Get the Usage Counter Hours I7GETUSG	28	0x1C
Set the Terminal Mode ON (Keyboard Mode) I7STERM	47	0x2F
Set the Packet Protocol Mode ON I7SPACKET	75	0x4B
Get the Low Power Mode Status I7GETLPM	37	0x25
Set the Low Power mode ON/OFF, (ON = Low Power Mode, OFF = Normal Mode) I7SETLPM	38	0x26
Get the Voltage Output Source I7GVOUT	88	0x58
Set the Voltage Output Source I7SVOUT	87	0x57
Get the Cooler Enable Status I7GCOOLING	90	0x5A
Get the Cooler Temperature I7GCOOLTMP	93	0x5D
Get the Cooler On/off Status I7GCOOLON	94	0x5E
Get the Cooler Linking Status I7GCOOLINK	95	0x5F
Get the Cooler Status I7GCOOLSTA	97	0x61
Set the Cooling Enable I7SCOOILING	92	0x5C
Set the Cooling Linking I7SCOOILINK	96	0x60
Set the web temperature filter setting I7STLFP	99	0x63
Get the web temperature filter setting I7GTLFP	101	0x65
Set the web temperature offset I7SWEBS	102	0x66
Get the web temperature offset I7GWEBB	103	0x67
Get the head temperature alarm status I7GALM	104	0x68
Clear the head temperature alarm I7CALM	105	0x69

Calibration and Standardization Commands

	<i>decimal</i>	<i>hex</i>

Get the Current Material Entry I7GETMAT	14	0x0E
Switch to another Calibration Table in the Library I7SETMAT	15	0x0F
Get the Calibration Mode of the Current Material Entry I7GMODE	16	0x10
Set the Calibration Mode (MULTI/QUICK) I7SMODE	17	0x11
Read the Calibration Table Entry I7RXMAT	27	0x1B
Set the Calibration Table Entry I7TXMAT	26	0x1A
Set the Offset for Standardization I7SETTIM	39	0x27
Set the Standard Moisture Value for Standardization I7SSTD	72	0x48
Get the Material Entry Number Used in Standardization I7GSTDM	71	0x47
Set the Offset Value for Standardization I7SSHIFT	67	0x43
Get the Offset Value Resulting from Standardization I7GSHIFT	68	0x44

	<i>decimal</i>	<i>hex</i>

<i>Get the Standard Value Set for Standardization</i> I7GSTD	73	0x49
<i>Standardize</i> I7STDZE	69	0x45
<i>Set the Standard Material Entry Number</i> I7SSTD	70	0x46

Data Acquisition Commands

	<i>decimal</i>	<i>hex</i>

<i>Get the Optical Head Temperature</i> I7GHEAD	79	0x4F
<i>Get the Optional Extra Web Temperature</i> I7GWEB2	100	0x64
<i>Start Sending the Head Temperature instead of the Web Temperature</i> I7GETTMP	46	0x2E
<i>Start Sending the Web Temperature Instead of the Head Temperature</i> I7GWEB	48	0x30
<i>Get expansion module signal</i> I7GXMOD	108	0x6C

Memory Bank Commands

	<i>decimal</i>	<i>hex</i>

<i>Read the Number of Samples in the Current Bank</i> I7GETDM	35	0x23
<i>Read the Bank Number</i> I7GBANK	55	0x37
<i>Get the Autotimer Mode</i> I7GAMODE	59	0x3B
<i>Get the Autotimer Status</i> I7GETAUTO	43	0x2B
<i>Clear the Current Data Series (or Bank)</i> I7CLRSE	21	0x15
<i>Take a Sample into the Current Data Series (or Bank)</i> I7SAMPLE	36	0x24
<i>Set the Autotimer ON</i> I7AUTOON	41	0x29
<i>Set the Autotimer OFF</i> I7AUTOOFF	42	0x2A
<i>Select the Bank</i> I7SBANK	54	0x36
<i>Set the Autotimer Mode</i> I7SAMODE	58	0x3A
<i>Get the Autotimer Interval in 0.1ms Units</i> I7GETTIM	40	0x28
<i>Get the Current Batch Size</i> I7GBATCH	57	0x39
<i>Set the Current Batch Size</i> I7SBATCH	56	0x38
<i>Set the Autotimer Interval in Seconds</i> I7SETTIM	39	0x27
<i>Get Samples from the Current Memory Bank</i> I7TXSER	20	0x14
<i>Copy the Temperature Series to Bank4</i> I7COPYT	98	0x62
<i>Set the Current Burst Size</i> I7SBURST	112	0x70
<i>Get the Current Burst Size</i> I7GBURST	113	0x71
<i>Set the Burst Mode</i> I7SBUM	114	0x72
<i>Get the Burst Mode</i> I7GBUM	115	0x73
<i>Get the Burst Mode Item Count</i> I7GBUC	116	0x74
<i>Clear the Burst Mode Item Count</i> I7CBUC	117	0x75

Text String Commands

	<i>decimal</i>	<i>hex</i>

<i>Get the Unit for Moisture</i> I7GUNIT	13	0x0D
<i>Get the Current Material Entry Name, part 1</i> I7GMATNM	31	0x1F
<i>Get the Current Material Entry Name, part 2</i> I7GMATNM2	77	0x4D
<i>Get the Current Library Name</i> I7GLIBNM	29	0x1D
<i>Get the Meter's Identifier String 1</i> I7TEST	10	0x0A
<i>Get the Meter's Identifier String 2</i> I7TEST2	78	0x4E

	<i>decimal</i>	<i>hex</i>
<hr/>		
<i>Get the Meter's Identifier String 3 I7TEST3</i>	80	0x50
<i>Set the Current Library Name I7SLIBNM</i>	30	0x1E
<i>Set the Unit for Moisture I7SUNIT</i>	12	0x0C
<i>Set a Material Name, part 1 I7SMATNM</i>	81	0x51
<i>Set a Material Name, Part 2 I7SMATNM2</i>	82	0x52
<i>Get expansion module name I7GXNAME</i>	110	0x6E

Special Commands

	<i>decimal</i>	<i>hex</i>
<hr/>		
<i>Get the LAN Addresses I7GLAN</i>	84	0x54
<i>Set the LAN Addresses I7SLAN</i>	85	0x55
<i>Initialize the Profibus DP slave I7DPINIT</i>	65	0x41
<i>Send a Short Pulse to the LED Indicator (if available on the connector panel) I7BEEP</i>	34	0x22
<i>Start Fast Fourier Transform in the Meter I7FFT</i>	83	0x53
<i>Get expansion module number I7GNXMOD</i>	109	0x6D
<i>Send a command to the expansion module I7SXCOM</i>	111	0x6F

1. Introduction and Taking into Use

This document instructs you on how to use the standardized industrial fieldbus interface **Profibus DP** with your meter. Refer to your existing **Profibus DP** operating manuals delivered by its manufacturer. For other features of the **AK50** moisture meter refer to PC User's Manual and to the User's Manual of the instrument.

General

AK50 and its derivatives are very high-speed process surface moisture transmitters for requiring conditions in paper machines and other comparable applications. The moisture measurement speed is at least 400 Hz. That speed can be exploited in different ways. One can acquire the latest moisture value into some control system in digital form either via the RS232/485 serial port (typically a PC) or via **Profibus DP** fieldbus (max 12 Mbauds RS485). The moisture signal can be read also in analog voltage form (0...+10 V, +/-5 V or 0...+5V). The moisture signal can be sampled and collected to the unit's own battery backed data memory at regular intervals from 2.5 ms to 36000 s. The data can later be retrieved from the memory as a data series. One external trigger line is available for starting either continuous sampling or sampling a preset batch.

The **Profibus DP** (DP = Distributed Processing) interface complements your fixed or traversing control system in an excellent way. With it you can acquire moisture and temperature readings from the meter to be used elsewhere in your system via the fieldbus. You can also switch to another calibration table, while operating, with a simple command. Also the calibration mode can be changed between QUICK and MULTI. The Low Power or Normal modes can be set to save the meter during a production stoppage. There are about one hundred different commands available. Practically all operations can be done without a PC. **AK50** works as a standard DP slave in the fieldbus. **Profibus DP** allows the use of very long operating distances, up to 1200 meters at lower data transmission rates. It can also handle quite a large number of slaves simultaneously and you can have several masters as well. One advantage is its international standardization (EN 50170 and DIN 19245). Compatible modules can be supplied by several manufacturers. It is a plug and play game. You can detach a module from the network without causing any harm to other nodes unless they are dependent on the data sent by this slave. You can plug in any slave into a hot connector and the master immediately takes it as part of the fieldbus network. Refer to your existing **Profibus DP** documentation for more details. More information of the fieldbus can be supplied by your local representative for Profibus components and systems.

Installation

For installing and configuring the **Profibus DP** for **AK50** successfully the following items should be available (refer to the complete packing list in the user's manual):

1. **AK50** instrument
2. Program diskette
3. User's manual (this)
4. Power source with cables
5. Connection cable with connectors and distributing box
6. **Profibus DP** cable into the distribution box

You will need also a **Profibus DP** cable with a D9 male connector which is connected to the existing network.

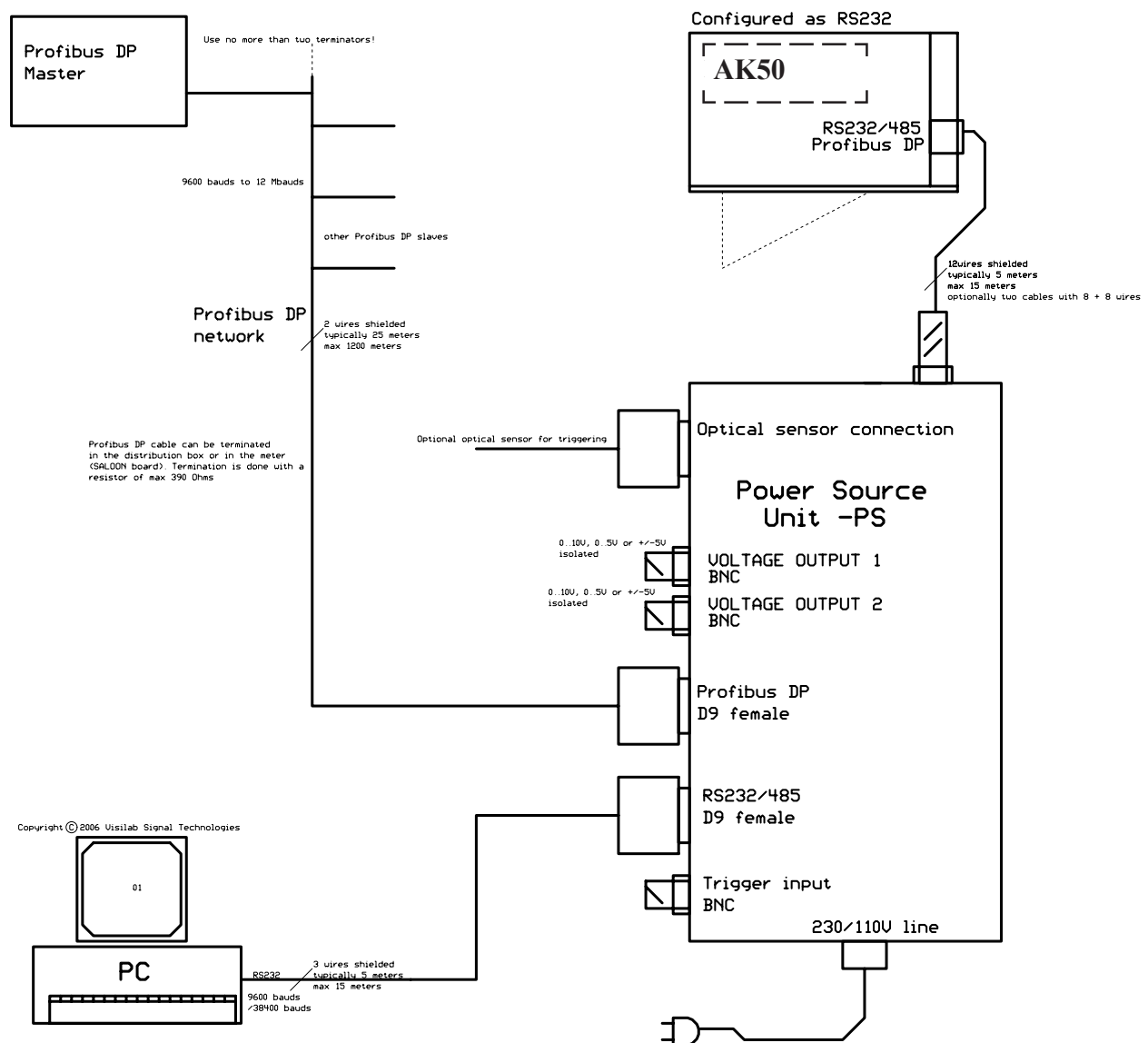


Figure 1. Assembly of electrical cables in AK50 for use via RS232 with a PC and Profibus DP simultaneously. The drawing is not to scale. The wire positioning may vary on the distribution box. The PC connection is optional in actual operation.

Connecting the Cables

After having checked the instrument operations as instructed in other manuals first, you can proceed as follows. Connect the cables as instructed in the **instrument user's manual** and test the PC interface operation as instructed in the PC User's Manual. Now we assume that the connections are all right and the PC part of the testing was successful.

The distribution box has a D9 connector for the PC serial cable and another similar for operating with the **Profibus DP** fieldbus (see Figure 1.). Connect the DP master to the **Profibus DP** connector. It does not matter what mode it is in, powered off, Stop, Clear or Operating.

The connector type used for the **Profibus DP** at the meter back panel is **Bulgin Mini Buccaneer** IP68 codes PX0800 (free body), 12735/1 (socket carrier) and SA3149/1 (socket). The pin numbering is the same as in the schematic (from 1 to 8) in Appendix 3.

Configuring

To actually configure your new DP slave you need to have some configuration tool for the fieldbus. The purpose of configuration is to tell the DP master what kind of input data can be retrieved from the slave and what kind output data can be sent to it. The most important specifications of **AK50** as a DP slave are the following:

- o 16 bytes input:
 - o 1. byte: moisture value whole
 - o 2. byte: moisture value fraction
 - o 3. byte: temperature value whole
 - o 4. byte: temperature value fraction
 - o 5. ..16. bytes parameters input
- o 16 bytes output:
 - o 1. byte: reserved (= 0)
 - o 2. byte: command
 - o 3. byte: data
 - o 4. byte: reserved (=0)
 - o 5. ..16. bytes parameters output
- o vendor ID: 0 (=zero)
- o time-out period: 20 ms
- o slave name: IRMA7D-001
- o Watchdog: ON
- o slave address: 3 (initially, can be changed with the aid of PC interface)
- o transmission rate: 1500 kbaud (default value for starting, the slave will adapt to any rate from 9600 baud to 12 Mbaud)
- o freeze mode: OFF
- o sync mode: OFF
- o minimum slave interval: 5 ms

Refer to Appendices 1. and 2. for the contents of the configuration database text files for other vital specifications used in configuring the slave. Note that accepting the slave is not successful if most of the parameters are not set correctly. The master can communicate only with a slave which has been configured correctly.

Troubleshooting Hint

The **Profibus DP** cable has two wires only plus a protecting shield in the minimum configuration. If the slave refuses to operate at all, swap the two pins in the cable connector. That should do it. Refer to Appendix 3. for schematics of the distribution box.

2. Using the PC Program to Help Configure

General Notes

In addition to other features mentioned in the PC User's Manual, the PC program offers you a way of configuring the meter for operation in **Profibus DP**. That is done in the keyboard mode or in the graphical mode in menu F5. In the PC program, press F9 to enter the keyboard mode. You can always press the F9 again to get back to the graphical interface.

Menus and Settings

To change settings, supposing you are in the measuring state, press 'm' to go to the main menu which looks like this:

1=Series 2=Calibr.
3=Mater. 4=Profibus
5=Service 6=LPF:MEDM
7=Unit 8=Comm's

Then press '4' to go to the **Profibus DP** menu:

0=Slave 8=ACTIVE
2=SetR 3=ReadR
6=IDLOW 7=IDHIGH
4=List 5=Init 9=Loop

Practically the only selection you may have to use in this menu is the option '0' for setting the slave address. **The default address is 3.** If your DP system already has a slave with that address you may have to change the address of **AK50**. Press '0' and a simple dialog asks you to edit the given address. Accept it after modifying it. To make it effective, you have to either power-off the meter or make a slave initialization by pressing '5'. Avoid using addresses reserved by other slaves or masters.

If by any chance, the **Profibus DP** support in this instrument has been deactivated, you can reactivate it here by pressing '8'. Also, if you wish to deactivate the fieldbus (not recommended) in case you have no use for it, press '8' to deactivate it. This menu always shows what will be the result of pressing the '8' key. Also a short text note will appear momentarily indicating the result of the operation. If the system has been inactive and you plan to take it into use, perform the initialization here as well ('5').

There is one situation which will automatically *deactivate* the fieldbus: ***When you perform the factory settings in the service menu. That, of course, should not be done without a very good reason. You will loose your calibration library in that process unless you have saved it.***

It is not recommended that you touch other alternatives in this menu in normal use. They are intended

for service personnel for diagnostic purposes. If by accident, you attempt to use them, please press '5' to initialize the fieldbus with correct settings. There is a possibility of changing the slave's ID. The ID's low byte is set in '6' and the high byte is set in '7'.

The meter has a DATAEX indicator lamp on the middle CPU board which is visible when the unit access cover is opened. When the lamp is off, the **Profibus DP** slave has been accepted as a correctly configured slave and data exchange is possible. If the lamp is ON, the slave is off-line and does not belong to the DP network. The master will always indicate successful slave parametrization and configuration. Refer to the DP master's manuals for operating the master. Refer to the **AK50** User's Manual for locating the indicator lamp.

3. Operating the Slave via Fieldbus

General

The **Profibus DP** fieldbus is based on slave polling and token passing between masters. Slave data is cyclically acquired and new output data is sent to those slaves that require it. Other features, like the PC interface, can be freely used simultaneously.

You can access the current moisture and temperature values of **AK50** with any **Profibus DP** master. The master can be a programmable logic controller (PLC), a more advanced industrial CPU or a PC-based master. The controllers have an embedded program which is usually downloaded from some workstation before the control system is set into operation. In a PC-based master there is a small add-on card having the master communications processor and other fieldbus hardware. The master always has software that can manage the fieldbus protocol and data exchange with other nodes in the fieldbus.

Each slave to be connected to the fieldbus has a number of special features which make it different from other slaves. These features have to be determined with some configuration tool. The data are saved into a text file and a binary database. The database is loaded to the master. Then it can recognize the new slave and communicate with it correctly.

Passing Commands

The procedure for sending any of these commands is the following. The default command that should normally be sent to a slave consists of zeros only. That will make it sure that no pending commands are processed. Note that it is required to send the command **only once** to a slave. Sending a command repeatedly will redo the same thing and possibly overload the slave. Do not send a command without a data byte if the command requires it. Refer to Appendix 4 for details.

The calibration table change is done immediately and the next moisture values will be linearized according to it. There is a short calculation period of less than 1 ms associated with the table change, during which time the acquired moisture value may be incorrect. That is however, usually not important due to the nature of the situation where this command is used.

While standardizing, note the following. The moisture standard should be placed under the meter in the proper position before starting this operation. If using a traverse, the meter head should be driven to that position where the standard is placed. In order to standardize correctly, the corresponding moisture reading of the standard should be set in the menu system as well as the calibration table which should be used for this purpose. The standardization menu can be found in the Calibration menu: **6=Std-ize**. There you will find the setting options. After having made this once you can later do the standardization automatically just by driving the head and sending the command. Nothing else is required.

Input Data

The input data information in **AK50** consists of the following:

- o 16 bytes input (bi1...bi16):
 - o 1. byte bi1: moisture value whole, **a continuously changing signal**
 - o 2. byte bi2: moisture value fraction, **a continuously changing signal**
 - o 3. byte bi3: temperature value whole, **a continuously changing signal**
 - o 4. byte bi4: temperature value fraction, **a continuously changing signal**
 - o 5..14 bytes bi5...bi14: parameter return values, these bytes **remain available until another command is sent which requires the use of any of these bytes.**
 - o 15...16 bytes bi15..bi16 bi15 contains the returned freely usable command identifier (ref. to next page) and bi16 contains **always** the slave status **sta**, which is described in more detail with the command I7GSTATUS.

The actual values are calculated as

$$\text{moisture} = \text{bi1} + (\text{bi2} / 100.0)$$

and

$$\text{temperature} = \text{bi3} + (\text{bi4} / 100.0)$$

Note that the moisture value may become negative in some special circumstances. That is indicated by the whole value as a signed character (255 = -1, 254 = -2 etc). The input data are retrieved usually very often. The cyclic rate depends on the number of slaves and masters in the system. Also the data transmission rate will affect it. Typical values are 50 to 100 Hz in a system with a few slaves at 187.5 kbaud rate. Naturally, the output data are sent simultaneously in each transaction. Note that the temperature data is the **web** temperature if your meter has the standard IR thermometer assembled. Else the reading will be the **head** temperature. The selection has been made at the factory. If you wish to change it you can use the commands **I7GWEB** and **I7GETTMP**. The setting stays until set again, irrespective of powering down the meter.

Output Data

The output data should be handled in the following way if any commands are sent to the slave. Using them is not required. If output is not used, the output data should always be set to zero, all four bytes.

- o 16 bytes output (bo1...bo16):
 - o 1. byte bo1: command identifier **cid**, available for free use
 - o 2. byte bo2 : command **com**
 - o 3. byte bo3: data *
 - o 4. byte bo4: data *
 - o 5..16 bytes bo5...bo16: data *

The general structure of the arrays input data and output data use the following pattern:

Example Command Explanation Header:

I7COMMAND	DD	0xHH
-----------	----	------

```
output data bo:
```

cid	com															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte
input data bi:																
mw	mf	tw	tf												cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

The fields filled with some identifiers mean that they are already fixed in their use. Their use is not changed in any command in any way and they reserve these fields permanently. The various bytes left empty are filled in each command differently. The short names of various bytes used to describe the bytes are below.

cid	command identifier (optional) - user defined
com	command - user defined, e.g. I7GSTATUS as a byte
*	general data, not defined more precisely
s	string data, one character of it, may be an end marker also (zero)
c	a single character data, unsigned char
i	integer data, lower or upper byte
l	long integer data, any of the four bytes
f	floating point data formatted as two integers, the whole part and the fractional part. Typically the data is put into four or two bytes
sta	status byte, unsigned char
0 (empty)	zero, set in command, returned in input data field not used, ignore any return values
mw	moisture whole
mf	moisture fraction
tw	temperature whole
tf	temperature fraction
xw	expansion module signal whole
xf	expansion module signal fraction

The first byte is has no immediate effects. The typical application is to use it as a sequential number which is **always returned with the next updated input data (bi15) which has the data required by the command**. One can easily separate input data belonging to each command sent and thus obtain the best possible polling speed. If one does not need it, one can forget it. The following commands are supported at this time (for details refer to the User's Manual). They are classified according to their purpose.

0x56

cid com																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte
input data bi:																	
mw mf tw tf 0 sta															cid sta		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

- o 5. byte bi5: 0
- o 6. byte bi6: status byte

bit	name	value 0	value 1
0:	burst mode	off, normal oper.	on, BURST mode
1:	analog output	moisture	web temperature
2:	quiet booting	no	yes
3:	linked autotimers	no	yes
4:	web OK, no break	FALSE	TRUE (depends on web)
5:	session start phase	OFF	ON
6:	reflective surface	false	true
7:	dark surface	false	true

17

Get the Third System Status:

I7G3STATUS

89

0x59

```
output data bo:
```

```

-----
|cid|com|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
-----
  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16
input data bi:

```

```
input data bi:
```

mw	mf	tw	tf	0	sta									cid	sta	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the status byte. The data will be valid until the next command requiring the use of the same bytes in return data is sent out. The form of the input data is the following:

- o 5. byte bi5: 0
- o 6. byte bi6: status byte

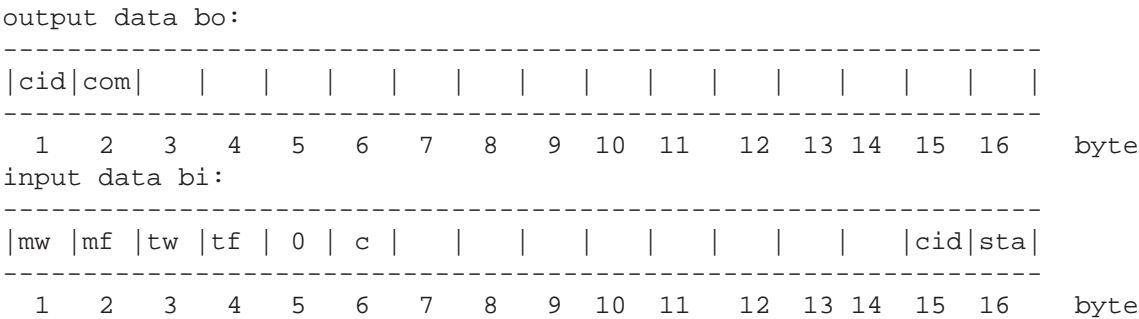
The 5th byte is kept as zero and is reserved for future use. The status data byte is bit-controlled and can have the following values.

bit	name	value = 0	value = 1
0:	cooling enable	off	on, cooler enabled
1:	cooling status	FAILURE, more air is needed	OK
2:	cooler linking	no	yes
3:	web break suspicion	no break	yes, a break is suspected
4:	web temperature filter	OFF	ON
5:	overtemperature alarm	OFF, OK	ON, overheating of head
6:	COMPOSER	inactive	active
7:	Expansion module	none	installed

Flag settings marked with **bold** are default values for general use when applying mainly **Profibus DP**. **The cooler settings are related to the meter hardware and apply only if a cooler exists.** The web break suspect bit is an attempt to indicate suspected web breaks when the gain locking is used. Refer also to the two commands before this one. The COMPOSER bit tells if the calibration expert system is installed into your moisture meter. If it is not supported, this bit reads zero.

Read the Filter Characteristics:

I7GFILTER 50 0x32



As a response to this request, the input fields, bytes 5 and 6 are used for returning the current filter setting. The data will be valid until the next command requiring the use of same bytes in return data is sent out. The form of the input data is the following and the setting may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: filter setting

The setting may have any of the following values:

OFF	120	0x78
FAST	121	0x79
MEDIUM	122	0x7A
SLOW	123	0x7B
SPECIAL	124	0x7C
BOX	125	0x7D

Refer to User's Manual for more details and effects of the filter setting.

Change the Filter Characteristics:

I7SFILTER 49 0x31

output data bo:

-----																byte
cid	com	c														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

input data bi:

-----																byte
mw	mf	tw	tf											cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

The output fields used are as follows:

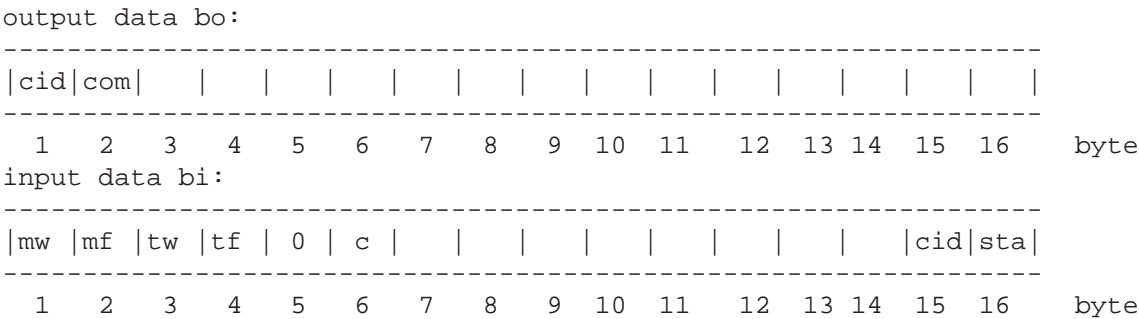
o 3. byte bo3: **filter** may have any of the following values:

symbol	dec. value	hex value

OFF	120	0x78
FAST	121	0x79
MEDIUM	122	0x7A
SLOW	123	0x7B
SPECIAL	124	0x7C
BOX	125	0x7D

The parameter **filter** may have any of these values causing also the corresponding filtering effect after initializing the filter system.

Get the Web Temperature Filter Status:
I7GTLPF 101 0x65



As a response to this request, the input fields, bytes 5 and 6 are used for returning the setting of the web thermometer low pass filter (LPF). The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: filter status

The status may be one of the following:

symbol	dec. value	hex value
on, data is filtered	1	0x01
off, no filter	0	0x00

Refer to User's Manual for more details. Using the filter will slow down the response time but will lower the noise. This filter does not affect the EXTRA thermometer input signal in any way nor does it affect the head temperature signal.

Set the Web Temperature Filter:
I7STLPF 99

0x63

output data bo:

cid	com	c														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

input data bi:

mw	mf	tw	tf											cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

The output fields used are as follows:

o 3. byte bo3:	mode	may have any of the following values:			
	OFF	0	0x00	web temperature filter is off	
	ON	1	0x01	web temperature filter is on	

Get the Locking Status:

I7GETLOCK 53 0x35

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	0	c									cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the signal locking status of the signal amplifier autoranging system. The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: locking status

The status may be one of the following:

symbol	dec. value	hex value

on, locked	1	0x01
off, autoranging	0	0x00

Refer to User's Manual for more details. Do not lock the gain if you do not know the resulting effects!

Set the Locking:**I7GAINLOCK****51****0x33**

output data bo:

cid	com															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf												cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

The command will change the locking accordingly and it will stay until set again, independent on power cutoff. After this command, the gain is locked. Using this command will avoid signal transients in critical measurements which could be resulted by the autoranging system changing automatically the system gain. Signal clipping and resulting strong distortion may occur if light signal increases too much. Refer to User's Manual for more details. Do not lock the gain if you do not know the resulting effects!

Set the Autoranging:**I7GAINOPEN****52****0x34**

output data bo:

cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw	mf	tw	tf													cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

The command will change the locking accordingly and it will stay until set again, independent on power cutoff. After this command, the gain is unlocked and the autoranging system is able to adapt to varying web conditions.

Get the Lamp Status:

I7GLAMP 74 0x4A

output data bo:

cid	com															

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

input data bi:

mw	mf	tw	tf	0	c										cid sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the light source status. Refer to I7GSTATUS for more details. The form of the input data is the following and the setting may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: status

Status may be one of the following:

symbol	dec. value	hex value

OK	1	0x01
fault	0	0x00

0x3C

Get the Usage Counter Hours:**I7GETUSG****28****0x1C**

output data bo:

cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

input data bi:

mw	mf	tw	tf	1		1		1		1							cid sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

As a response to this request, the input fields, bytes 5 to 8 are used for returning the usage counter reading in hours of active time. The form of the input data is the following:

- o 5. byte bi5: MSB of usage hours
- o 6. byte bi6: HMEDB byte of usage hours
- o 7. byte bi7: LMEDB byte of usage hours
- o 8. byte bi8: LSB of usage hours

The usage is calculated as **hours * (LSB + 256 * LMEDB + 65536 * HMEDB + 16777216 * MSB)**

Set the Terminal Mode ON (Keyboard Mode):
I7STERM 47 0x2F

output data bo:															
cid	com														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
input data bi:															
mw	mf	tw	tf											cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

As a result of this command, the Keyboard mode is turned on in the RS232 serial port interface.

Set the Packet Protocol Mode ON:**I7SPACKET****75****0x4B**

output data bo:

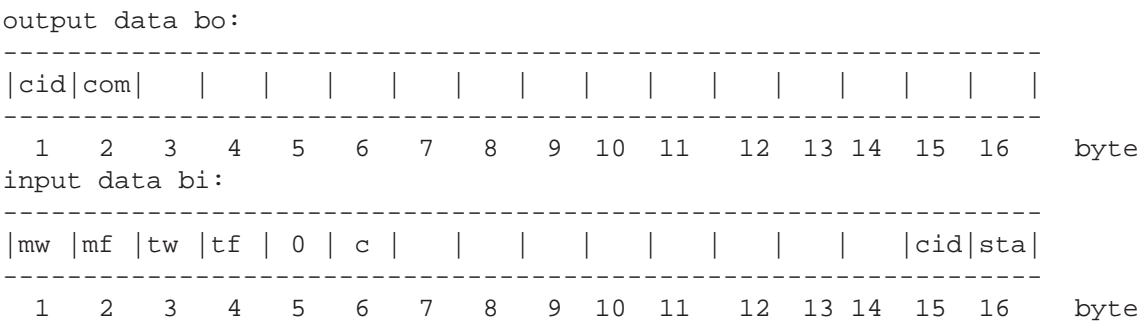
cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw	mf	tw	tf													cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

As a result of this command, the Packet protocol mode is turned on in the RS232 serial port interface.

Get the Low Power Mode Status:
I7GETLPM **37** **0x25**



As a response to this request, the input fields, bytes 5 and 6 are used for returning the low power mode status. Refer to I7GSTATUS for more details. The form of the input data is the following and the setting may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: status

Status may have one of the following values:

symbol	dec. value	hex value

Low Power	1	0x01
Normal	0	0x00

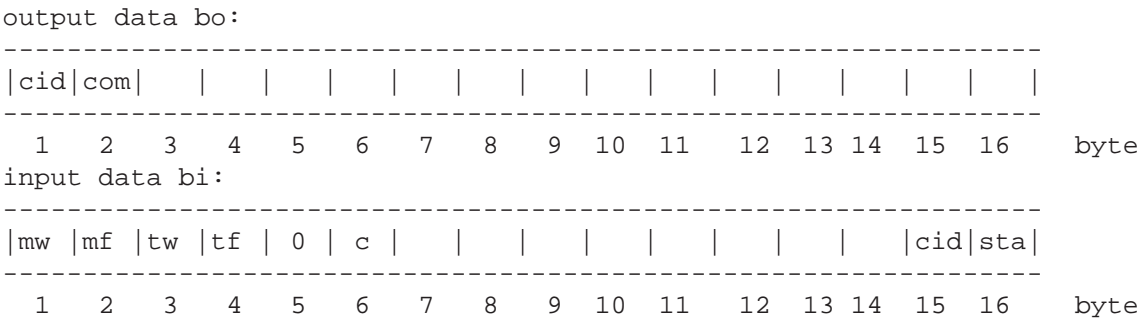
0x26

mw	mf	tw	tf											cid	sta	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

may have any of the following values:

OFF	0	0x00
ON	1	0x01

Get the Voltage Output Source:
I7GVOUT 88 0x58



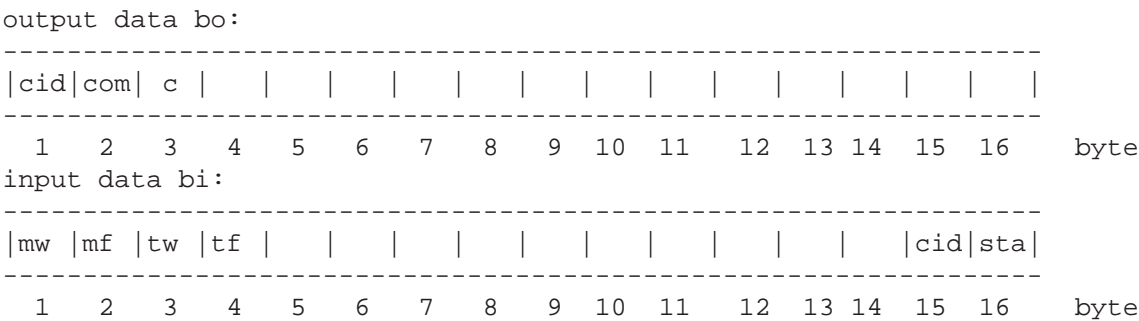
As a response to this request, the input fields, bytes 5 and 6 are used for returning the source of voltage output signal. The form of the input data is the following and the setting may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: selection

The selection may be one of the following:

symbol	dec. value	hex value
Moisture	0	0x00
Web temperature	1	0x01
Head temperature	2	0x02
Extra temperature	3	0x03

Set the Voltage Output Source:
I7SVOUT 87 0x57

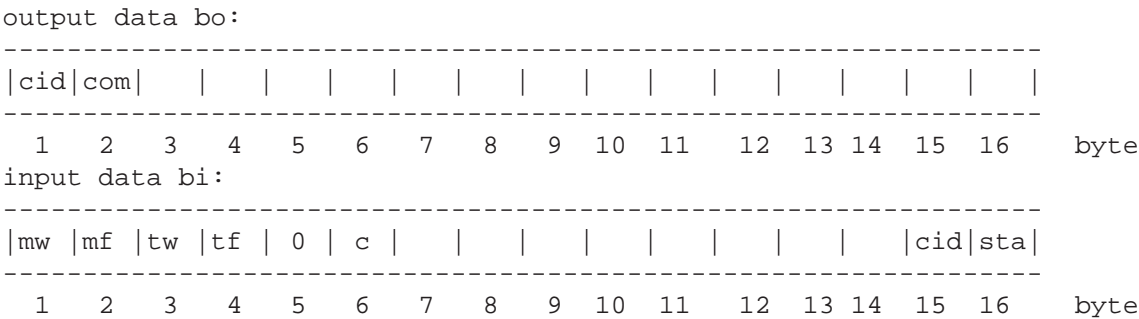


The output fields used are as follows:

o 3. byte bo3:		selection	having values:
symbol		dec. value	hex. value
<hr/>			
Moisture		0	0x00
Web temperature		1	0x01
Head temperature		2	0x02
Extra temperature		3	0x03

The parameter will change the selection with a delay of 5 ms maximum to be seen at the analog output connector.

Get the Cooler Enable Status:
I7GCOOLING 90 0x5A



As a response to this request, the input fields, bytes 5 and 6 are used for returning the cooler enable status. The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: cooler enable status

The status may be one of the following:

symbol	dec. value	hex value

on	1	0x01
off	0	0x00

Refer to User's Manual for more details. Do not enable the cooler unless you know the resulting effects! To use the cooler, it must be installed into your meter.

0x5D

cid com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte
input data bi:																
mw mf tw tf i i															cid sta	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

- o 5. byte bi5: high byte of temperature (integer in C)
- o 6. byte bi6: low byte of temperature (**parts of 1/100**)

The actual temperature is calculated as follows:

36

Get the Cooler On/off Status:

I7GCOOLON 94 0x5E

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	0	c									cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the cooler on/off status which may be different than the enable status due to the possible dependence on linking to Low Power mode. The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: cooler status

The status may be one of the following:

symbol	dec. value	hex value

on	1	0x01
off	0	0x00

Refer to User's Manual for more details. Do not enable the cooler unless you know the resulting effects! To use the cooler, it must be installed into your meter.

Get the Cooler Linking Status:
I7GCOOLINK 95

0x5F

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	0	c									cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the cooler linking status. The cooler may be linked to Low Power mode. It means, that the cooler will be turned to off when the Low Power mode is active. The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: cooler linking

The status may be one of the following:

symbol	dec. value	hex value

on, linked to Low Power	1	0x01
off, not linked	0	0x00

Refer to User's Manual for more details. Do not enable the cooler unless you know the resulting effects!
To use the cooler, it must be installed into your meter.

Get the Cooler Status:
I7GCOOLSTA 97 0x61

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
byte															

input data bi:

mw	mf	tw	tf	0	c									cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
byte															

As a response to this request, the input fields, bytes 5 and 6 are used for returning the cooler operational status. The cooler may fail in operation due to insufficient purge air flow. The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: cooler status

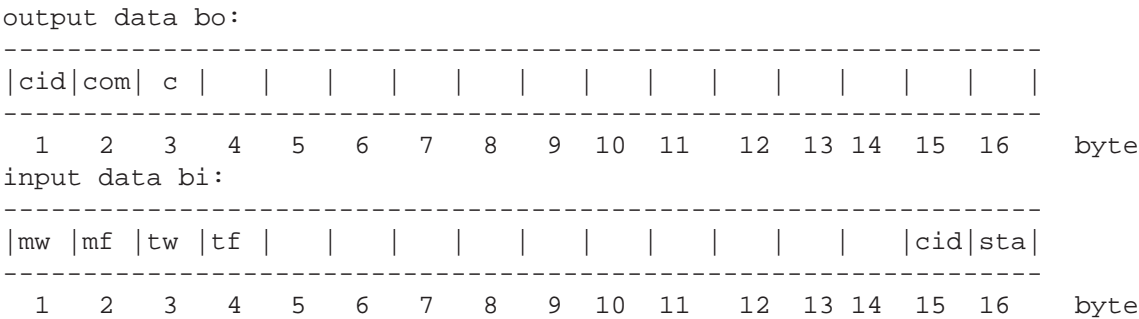
The status may be one of the following:

symbol	dec. value	hex value

OK	1	0x01
FAIL,need more purge air	0	0x00

Referto User's Manual for more details. Do not enable the cooler unless you know the resulting effects!
 To use the cooler, it must be installed into your meter.

Set the Cooling Enable:
I7SCOOLING 92 0x5C



The output fields used are as follows:

o 3. byte bo3:

selection

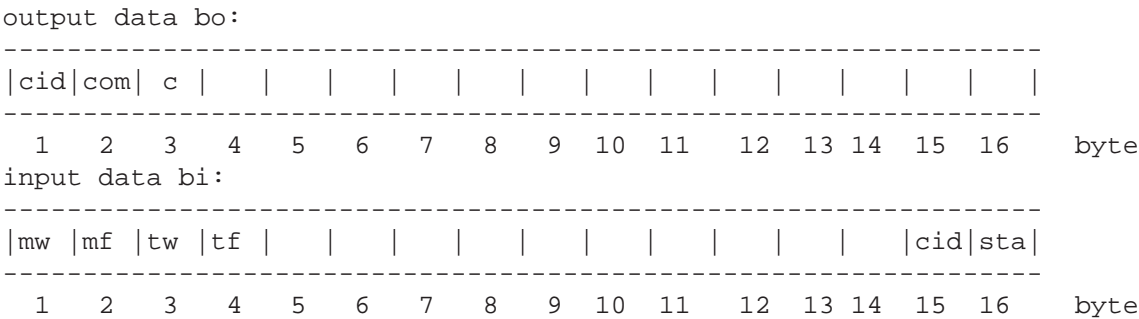
having values:

symbol	dec. value	hex. value

cooler disabled	0	0x00
cooler enabled	1	0x01

Refer to User's Manual for more details. Do not enable the cooler unless you know the resulting effects!
 To use the cooler, it must be installed into your meter.

Set the Cooling Linking:
I7SCOOLINK **96** **0x60**



The output fields used are as follows:

o 3. byte bo3:

selection

having values:

symbol	dec. value	hex. value

cooler not linked	0	0x00
cooler linked to Low Power	1	0x01

Refer to User's Manual for more details. Do not enable the cooler unless you know the resulting effects!
To use the cooler, it must be installed in your meter.

Get the Web Temperature Offset:**I7GWEBB****103****0x67**

output data bo:

cid com																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw mf tw tf two tfo								cid sta								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the offset in temperature as a Celsius reading. The form of the input data is the following:

- o 5. byte bi5: offset value whole
- o 6. byte bi6: offset value fractional (**parts of 1/100**)

The actual offset is calculated as follows:

$$\text{offset value (C)} = \text{offset value whole} + (\text{offset value fractional} / 100)$$

The offset is used for adjusting the thermometer in case it shows any long-term drift. The correct way to check it is to measure a temperature of an object of 21 - 26 C with a reliable meter and AK50's own web thermometer. The offset is then adjusted to match the reading of the reference meter. Do not do this at any other temperature as it may lead to increased nonlinearity of the signal! There may already be some reading for a unit leaving the factory. That is quite normal.

Set the Offset for Web Temperature:

I7SWEBB 102 0x66

output data bo:

cid	com	f		f		f		f							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf											cid	sta

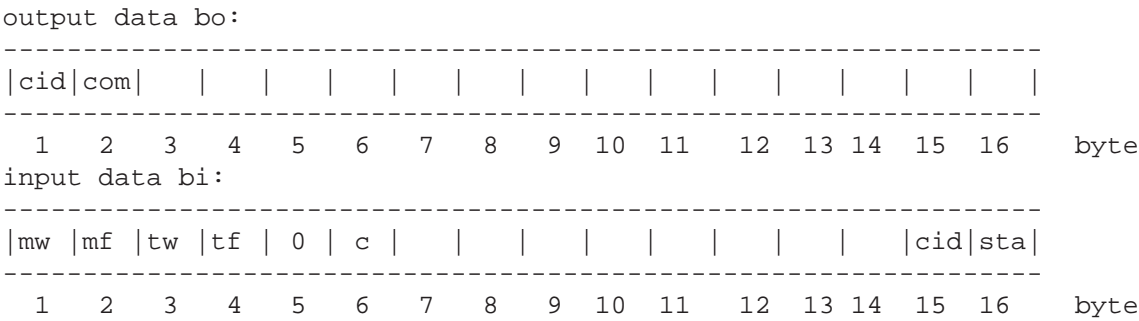
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

The output fields used are as follows:

- o 3. byte bo3: high byte of temperature offset value whole as integer
- o 4. byte bo4: low byte of temperature offset value whole as integer
- o 5. byte bo5: high byte of temperature offset value fraction as integer * 10000
- o 6. byte bo6: low byte of temperature offset value fraction as integer * 10000

With this command one can force the result of the web temperature to change if there is any reason to expect the thermometer's reading to have some sort of long-term drift.

Get the Head Overtemp Status:
I7GALM **104** **0x68**



As a response to this request, the input fields, bytes 5 and 6 are used for returning the optical head overheating status. Refer to I7CALM for more details. The form of the input data is the following and the setting may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: alarm status

Status may be one of the following:

symbol	dec. value	hex value

OK, no alarm	0	0x00
overheating of the head	1	0x01

Clear the Head Overheating Alarm:**I7CALM****105****0x69**

output data bo:

cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

input data bi:

mw	mf	tw	tf													cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

This command will clear the alarm situation which will persist **until** it is specifically cleared. Manual clearing is done in the Keyboard mode by entering and leaving the Menu at least once. Via Profibus DP the only way to clear the alarm is to use this command. Pay attention to the fact that the meter is put into Low Power mode as well. To restart it you have to restore it into Normal operation with the proper command. One should always find out the reasons for overheating to protect your investment and avoid any damage to the instrument. Use air purge and the internal cooler to avoid overheating. If that is not sufficient as your conditions for measurement are so extremely difficult, use some kind of heat shield to protect the meter. Consult Visilab if you need advice.

Calibration and Standardization Commands

Get the Current Material Entry:**I7GETMAT 14 0x0E**

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	0	c									cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the current material entry number. The form of the input data is the following:

- o 5. byte bi5: 0
- o 6. byte bi6: entry (1...100) (0x00...0x64)

Switch to another Calibration Table in the Library:**I7SETMAT****15****0x0F**

output data bo:

```

-----
|cid|com| c |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
-----
  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte
input data bi:

```

```

-----
|mw |mf |tw |tf |   |   |   |   |   |   |   |   |   |   |   |cid|sta|
-----
  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte

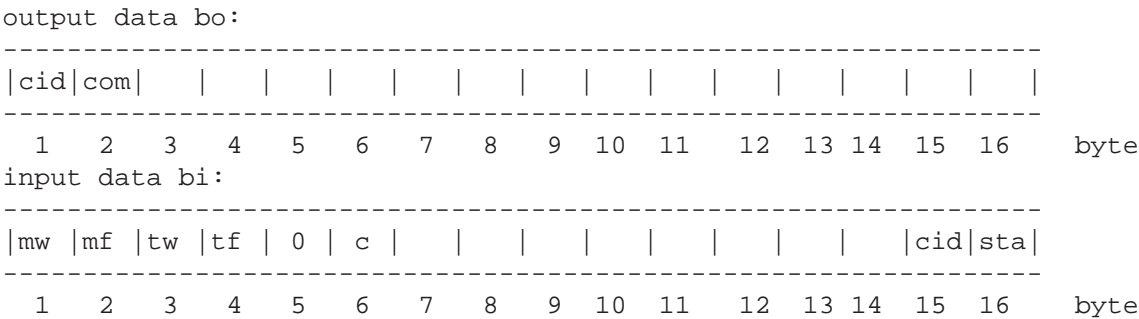
```

The output fields used are as follows:

- o 3. byte bo3: table entry (1...100) (0x01...0x64)

The effect of using this command is switching to using another table in the calibration library. The switching takes actually some time and the resulting moisture values are not reliable for about two seconds. However, due to the nature of the situation of the table switching, this should not be no problem.

Get the Calibration Mode of the Current Material Entry:
I7GMODE **16** **0x10**



As a response to this request, the input fields, bytes 5 and 6 are used for returning the mode which is used for the current material entry. The form of the input data is the following:

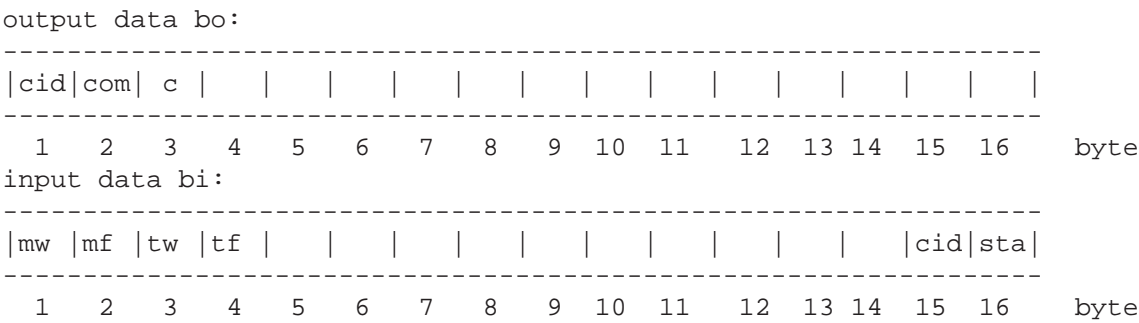
- o 5. byte bi5: 0
- o 6. byte bi6: mode

Mode may be one of the following:

symbol	dec. value	hex value
QUICK	78	0x4E
MULTI	79	0x4F

Remember that the QUICK mode is the global two-point calibration overriding the table chosen.

Set the Calibration Mode (MULTI/QUICK):
I7SMODE 17 0x11



The output fields used are as follows:

o 3. byte bo3:		mode	may have any of the following values:
symbol	dec. value	hex value	
<hr/>			
QUICK	78	0x4E	
MULTI	79	0x4F	

With this command one can read part of the contents of a calibration table entry. One can get an entire table information e.g. for saving by sending a few commands I7RXMAT from the DP Master. Note that the entry's material name can be read with another command I7GMATNM.

Set the Calibration Table Entry:**I7TXMAT****26****0x1A**

output data bo:

cid	com	c		c		c		c		c		f		f	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

The output fields used are as follows:

- o 3. byte bo3: entry number of table to be set
- o 4. byte bo4: the total number of steps in calibration table (1...10)
- o 5. byte bo5: calibration mode of this table (refer to command I7SMODE 17)
- o 6. byte bo6: number of step in calibration table (1...10) element to be returned
- o 7. byte bo7: signal/moisture table selector (0 = signal, 1 = moisture)
- o 8. byte bo8: high byte of signal/moisture(step) whole as integer
- o 9. byte bo9: low byte of signal/moisture(step) whole as integer
- o 10. byte bo10: high byte of signal/moisture(step) fraction as integer * 10000
- o 11. byte bo11: low byte of signal/moisture(step) fraction as integer * 10000
- o 12. byte bo12: high byte of signal/moisture(step) whole as integer
- o 13. byte bo13: low byte of signal/moisture(step) whole as integer
- o 14. byte bo14: high byte of signal/moisture(step) fraction as integer * 10000
- o 15. byte bo15: low byte of signal/moisture(step) fraction as integer * 10000

As a response to this request, the output fields, bytes 8 to 15 are used for setting two table elements of signal or moisture. The elements are either signal(step) and signal(step+1) or moisture(step) and moisture(step+1). The complete table consists always of elements:

step	signal	moisture

1	signal(1)	moisture(1)
2	signal(2)	moisture(2)
3	signal(3)	moisture(3)
4	signal(4)	moisture(4)
5	signal(5)	moisture(5)
6	signal(6)	moisture(6)
7	signal(7)	moisture(7)
8	signal(8)	moisture(8)
9	signal(9)	moisture(9)
10	signal(10)	moisture(10)

The actual number of steps in the table is from 2 to 10. It is not possible to add extra elements into the table. note that the element(step=11) would be placed on top of element(10). The signal value varies typically around 1.00. If invalid entry or step values are attached to a command, no actions are taken.

With this command one can set part of the contents of a calibration table entry. One can construct an entire table by sending a few commands I7TXMAT from the DP Master. Note that the entry's material name can be set with another command I7SMATNM.

I7SSHIFT	67	0x43
----------	----	------

cid com	f	f	f	f													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte
input data bi:																	
mw	mf	tw	tf												cid sta		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

- o 3. byte bo3: high byte of moisture offset value whole as integer
- o 4. byte bo4: low byte of moisture offset value whole as integer
- o 5. byte bo5: high byte of moisture offset value fraction as integer * 10000
- o 6. byte bo6: low byte of moisture offset value fraction as integer * 10000

54

I7STD	72	0x48
-------	----	------

cid com	f	f	f	f												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte
input data bi:																
mw mf tw tf															cid sta	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

- o 3. byte bo3: high byte of moisture standard value whole as integer
- o 4. byte bo4: low byte of moisture standard value whole as integer
- o 5. byte bo5: high byte of moisture standard value fraction as integer * 10000
- o 6. byte bo6: low byte of moisture standard value fraction as integer * 10000

55

Get the Material Entry Number Used in Standardization:
I7GSTDM 71 0x47

output data bo:

cid	com																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				

input data bi:

mw	mf	tw	tf	0	c													cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				

As a response to this request, the input fields, bytes 5 and 6 are used for returning the entry number.
 The form of the input data is the following:

- o 5. byte bi5: 0
- o 6. byte bi6: table entry (1...100)

Get the Offset Value Resulting from Standardization:

17GSHIFT

68

0x44

```
output data bo:
```

cid com																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw	mf	tw	tf	mwo	mfo									cid	sta	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the offset in moisture as a percent reading. The form of the input data is the following:

- o 5. byte bi5: offset value whole
- o 6. byte bi6: offset value fractional (*100)

The actual offset is calculated as follows:

$$\text{shift value (\%)} = \text{shift value whole} + \text{shift value fractional} / 100$$

Get the Standard Value Set for Standardization:

17GSTD

73

0x49

```
output data bo:
```

cid com																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

```
input data bi:
```

mw	mf	tw	tf	mws	mfs									cid	sta	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the actual standard sample reading in moisture in percents. The form of the input data is the following:

- o 5. byte bi5: standard value whole
- o 6. byte bi6: standard value fractional (*100)

The actual offset is calculated as follows:

standard value (%) = standard value whole + standard value fractional / 100

Standardize:

I7STDZE 69 0x45

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
input data bi:															

mw	mf	tw	tf											cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

Set the Standard Material Entry Number:**I7SSTD** **70** **0x46**

output data bo:

cid	com	c													

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

The output fields used are as follows:

- o 3. byte bo3: **entry** (1...100) (0x01...0x64)

This entry number is used in the standardization operation.

Data Acquisition Commands

Get the Optical Head Temperature:

I7GHEAD 79 0x4F

output data bo:

cid	com															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf	twh	tfh										cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the head temperature. The form of the input data is the following:

- o 5. byte bi5: whole part of temperature
- o 6. byte bi6: decimal part of temperature (*100) (**parts of 1/100**)

The actual temperature is calculated as follows:

temperature (C) = temperature whole + temperature fractional / 100

Get the Optional Extra Web Temperature:**I7GWEB2****100****0x64**

output data bo:

cid com																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw mf tw tf tw2 tf2								cid sta								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the optional web temperature if your meter's hardware support it. The form of the input data is the following:

- o 5. byte bi5: whole part of temperature
- o 6. byte bi6: decimal part of temperature (*100) **(parts of 1/100)**

The actual web temperature is calculated as follows:

web temperature (C) = temperature whole + temperature fractional / 100

This is an optional feature in some meters having two web thermometers.

Start Sending the Head Temperature instead of the Web Temperature:

I7GETTMP 46 0x2E

output data bo:

```
-----
|cid|com|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
-----
 1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte
input data bi:
```

```
-----
|mw |mf |tw |tf |  |  |  |  |  |  |  |  |  |  |  |cid|sta|
-----
 1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte
```

This command will turn on the head temperature as the data sent out via polling the temperature field.

Start Sending the Web Temperature Instead of the Head Temperature:**I7GWEB****48****0x30**

output data bo:

```

-----
|cid|com|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
-----
 1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte
input data bi:

```

```

-----
|mw |mf |tw |tf |  |  |  |  |  |  |  |  |  |  |  |cid|sta|
-----
 1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte

```

This command will turn on the web temperature as the data sent out via polling the temperature field.

Get the Expansion Module Signal:

I7GXM0D

108

0x6C

output data bo:

cid	com															

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

input data bi:

mw	mf	tw	tf	xw	xf								cid	sta		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the expansion module signal. The form of the input data is the following:

- o 5. byte bi5: whole part of expansion module signal, xh
- o 6. byte bi6: fractional part of expansion module signal (*100), xf, **(parts of 1/100)**

The actual expansion module signal is calculated as follows:

signal(G) = signal whole + signal fractional / 100

The unit is now marked as G as in general, the unit is not known. The signal may have negative values as well. The optional module may be a special measuring unit or it may have some other purpose.

Memory Bank Commands

Read the Number of Samples in the Current Bank:**I7GETDM****35****0x23**

output data bo:

cid	com															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf	i	i										cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the number of samples in the current bank. The form of the input data is the following:

- o 5. byte bi5: high byte of count
- o 6. byte bi6: low byte of count

Read the Bank Number:

I7GBANK 55 0x37

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	0	c									cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the identifier of the current bank. The form of the input data is the following and the setting may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: **bank**

bank may be one of the following:

symbol	dec. value	hex. value

Series with 4096 points	0	0x00
Bank1 with 1024 points	1	0x01
Bank2 with 1024 points	2	0x02
Bank3 with 1024 points	3	0x03
Bank4 with 1024 points	4	0x04

Select the Bank:

I7SBANK 54 0x36

output data bo:

cid	com	c													

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

byte

The output fields used are as follows:

- o 3. byte bo3: **bank**

bank may be one of the following:

symbol	dec. value	hex. value

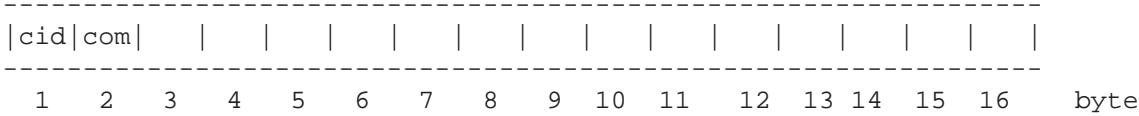
Series with 4096 points	0	0x00
Bank1 with 1024 points	1	0x01
Bank2 with 1024 points	2	0x02
Bank3 with 1024 points	3	0x03
Bank4 with 1024 points	4	0x04

The parameter **bank** causes immediate bank switching to the corresponding bank. Invalid bank references cause no action. Always one of the banks is selected as the current bank.

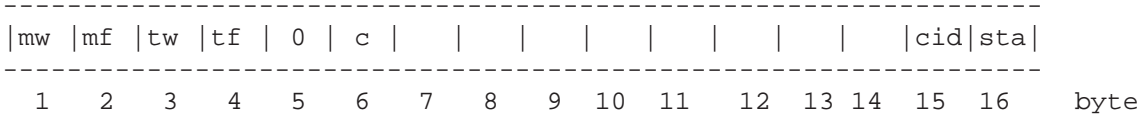
Get the Autotimer Status:

I7GETAUTO 43 0x2B

output data bo:



input data bi:



As a response to this request, the input fields, bytes 5 and 6 are used for returning the autotimer status. The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: autotimer status

The status may be one of the following:

symbol	dec. value	hex value

ON	1	0x01
OFF	0	0x00

Clear the Current Data Series (or Bank):

I7CLRSE 21 0x15

output data bo:

-----																byte
cid	com															

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

input data bi:

-----																byte
mw	mf	tw	tf											cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

This command will clear the data series in the current memory bank.

Take a Sample into the Current Data Series (or Bank):

I7SAMPLE 36 0x24

output data bo:

cid	com																

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

input data bi:

mw	mf	tw	tf												cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

This command will add the latest moisture reading to the data series in the current bank.

Set the Autotimer ON:

I7AUTOON

41

0x29

output data bo:

cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

input data bi:

mw	mf	tw	tf												cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

This command will turn on the autotimer. It will stay on until it is turned off (continuous or Normal operation) or it will be turned off automatically (Batch mode) after fetching the predetermined number of samples. Even in Batch mode the autotimer can be turned off. This will affect the web temperature autotimer as well if they are linked together. Note that the web temperature data is collected to a special memory bank with a rate of 16 samples / s. In earlier SW versions, this rate was one sample / second. The Autotimer is used in the Burst mode too but its control is fully given to the mode as soon as the Autotimer is started. The preset number, Burst count, is acquired at preset time intervals of the Autotimer. Then, the Autotimer is turned off by the mode itself.

Set the Autotimer OFF:

I7AUTOOFF

42

0x2A

output data bo:

cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw	mf	tw	tf													cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

This command will turn off the autotimer, independent on the mode. This will affect the web temperature autotimer as well if they are linked together. The Autotimer is used in the Burst mode too but its control is fully given to the mode as soon as the Autotimer is started. The preset number, Burst count, is acquired at preset time intervals of the Autotimer. Then, the Autotimer is turned off by the mode itself.

Set the Autotimer Mode:

I7SAMODE

58

0x3A

output data bo:

cid	com	c													

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

The output fields used are as follows:

o 3. byte bo3: **mode** having values:

symbol	dec. value	hex. value

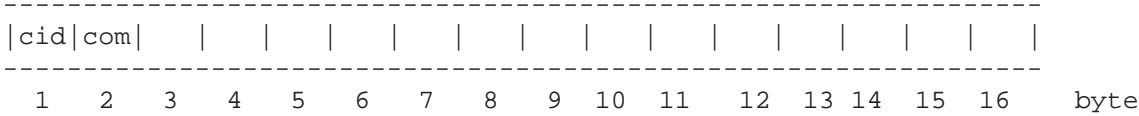
Normal	1	0x01
Batch	0	0x00

The parameter will change the autotimer mode accordingly. The Burst mode has no use for this mode as it has its own "Batch" count, the Burst count.

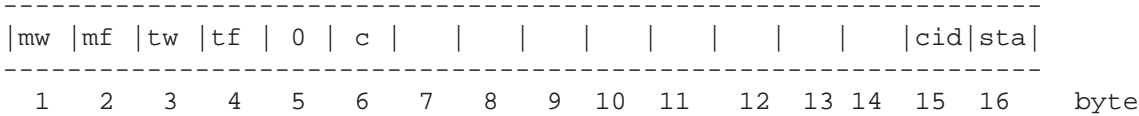
Get the Autotimer Mode:

I7GAMODE 59 0x3B

output data bo:



input data bi:



As a response to this request, the input fields, bytes 5 and 6 are used for returning the autotimer mode. The form of the input data is the following and the setting may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: autotimer mode

The mode may be one of the following:

symbol	dec. value	hex value

Normal	1	0x01
Batch	0	0x00

Get the Autotimer Interval in 0.1ms Units:

I7GETTIM

40

0x28

```
output data bo:
```

cid com																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte
input data bi:																	
mw mf tw tf	1	1	1	1											cid sta		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

As a response to this request, the input fields, bytes 5 to 8 are used for returning the autotimer sampling interval. The form of the input data is the following and the setting may be from 0.0025 to 32000 s.

- o 5. byte bi5: MSB of interval
- o 6. byte bi6: HMEDB byte of interval
- o 7. byte bi7: LMEDB byte of interval
- o 8. byte bi8: LSB of interval

The interval is calculated as **0.1ms * (LSB + 256 * LMEDB + 65536 * HMEDB + 16777216 * MSB)**

Set the Autotimer Interval in Seconds:

I7SETTIM

39

0x27

output data bo:

cid	com	i		i		i		i							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

byte

The output fields used are as follows:

- o 2. byte bo2: high byte of interval value whole as integer
- o 3. byte bo3: low byte of interval value whole as integer
- o 4. byte bo4: high byte of interval value fraction as integer * 10000
- o 5. byte bo5: low byte of interval value fraction as integer * 10000

The setting may be from 0.0025 to 32000 s in increments of 0.0025 s. Invalid settings are limited in value.

Get the Current Batch Size:

I7GBATCH**57****0x39**

output data bo:

cid	com															

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

input data bi:

mw	mf	tw	tf	i	i									cid sta		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the current batch size. The form of the input data is the following:

- o 5. byte bi5: high byte of batch count
- o 6. byte bi6: low byte of batch count

Set the Current Batch Size:

I7SBATCH

56

0x38

output data bo:

cid	com			i	i											

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

input data bi:

mw	mf	tw	tf										cid	sta		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

The output fields used are as follows:

- o 5. byte bo5: high byte of batch count
- o 6. byte bo6: low byte of batch count

Get Samples from the Current Memory Bank:

I7TXSER

20

0x14

output data bo:

cid	com	i		i											

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	mw1	mf1	mw2	mf2	mw3	mf3	mw4	mf4			cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 to 12 are used for returning four moisture samples. The output fields used are as follows:

- o 2. byte bo2: high byte sample index (1...4096 or 1...1024 depending on the current bank)
- o 3. byte bo3: low byte sample index

The form of the resulting input data is the following:

- o 5. byte bi5: moisture whole, sample index
- o 6. byte bi6: moisture fractional (*100), sample index
- o 7. byte bi7: moisture whole, sample index + 1
- o 8. byte bi8: moisture fractional (*100), sample index + 1
- o 9. byte bi9: moisture whole, sample index + 2
- o 10. byte bi10: moisture fractional (*100), sample index + 2
- o 11. byte bi11: moisture whole, sample index + 3
- o 12. byte bi12: moisture fractional (*100), sample index + 3

The actual moisture is calculated as follows for each of the four samples:

moisture (%) = moisture whole + moisture fractional / 100

Note that the index to be used depends on the bank you are using. Also the number of samples actually collected into it is important. If you have taken only 128 samples but are indexing at sample number 256 to start, the data will be totally improper. Also, for example, if you index to 255 and have taken only 256 samples into the array, ignore samples after #256. If bank boundaries are exceeded, the data may be zero or invalid. Negative indices will be ignored and the earlier data is returned.

Copy the Temperature Series to Bank4:

I7COPYT 98 0x62

output data bo:

cid	com	c														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf											cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

This command copies the data series collected with the temperature autotimer to an independent bank to the globally visible Bank4. The original special memory bank is cleared.

Get the Current Burst Size:

I7GBURST**113****0x71**

output data bo:

cid	com															

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

input data bi:

mw	mf	tw	tf	i	i									cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the current burst size. The form of the input data is the following:

- o 5. byte bi5: high byte of burst count
- o 6. byte bi6: low byte of burst count

Set the Current Burst Size:

I7SBURST

112

0x70

output data bo:

cid	com				i	i										

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf												cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

The output fields used are as follows:

- o 5. byte bo5: high byte of burst count
- o 6. byte bo6: low byte of burst count

Set the Burst Mode:

I7SBUM 114 0x72

output data bo:

cid	com	c													

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

byte

The output fields used are as follows:

o 3. byte bo3: **selection** having values:

symbol		dec. value	hex. value

burst mode off	0	0x00	
burst mode on	1	0x01	

Refer to User's Manual for more details of the burst mode. It overrides the normal Autotimer operation in some ways.

Get the Burst Mode:

I7GBUM 115 0x73

output data bo:

cid	com															

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf	0	c								cid	sta		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the burst mode setting. The form of the input data is the following and the status may be one of the values in the table:

- o 5. byte bi5: 0
- o 6. byte bi6: burst mode

The status may be one of the following:

symbol	dec. value	hex value

burst mode on	1	0x01
burst mode off	0	0x00

Refer to User's Manual for more details.

Get the Current Burst Mode Item Count:

I7GBUC

116

0x74

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	i	i	i	i								cid sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 to 8 are used for returning the current item count. The form of the input data is the following (long int):

- o 5. byte bi5: MSB byte of item count
- o 6. byte bi6: 3. byte of item count
- o 7. byte bi7: 2. byte of item count
- o 8. byte bi8: LSB byte of item count

Clear the Current Burst Mode Item Count:

I7CBUC

117

0x75

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf												cid sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

This command will clear the item counter used with the burst mode.

Text String Commands

Get the Unit for Moisture:**I7GUNIT****13****0x0D**

output data bo:

cid com																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw	mf	tw	tf	s	s	s	s	s	s	s	s	s	s	cid sta		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 to 14 are used for returning the unit used in displaying the moisture reading in the meter itself. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string
- o 13. byte bi13: s(8) 9. character of string
- o 14. byte bi14: s(9) 10. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string is 10 characters, there is no end marker. The unit is constructed easily as a string from this data. Usually, the unit is maximum 6 characters long.

Get the Current Material Entry Name, part 1:

I7GMATNM

31

0x1F

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	s	s	s	s	s	s	s	s	s	s	s	cid sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 to 14 are used for returning the material name used in the meter for linearization. The name is divided into two parts to fit the space of 10 characters available for transfer. If all byte fields are in use, there is no end marker. The first part consists of the first 10 characters maximum of the name and the second part consists of the rest if any. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string
- o 13. byte bi13: s(8) 9. character of string
- o 14. byte bi14: s(9) 10. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string transferred is 10 characters, there is no end marker. The name is constructed easily as a string from this data and possibly also from the second part. Usually, the material name is maximum 20 characters long in total.

Get the Current Material Entry Name, part 2:

I7GMATNM2

77

0x4D

output data bo:

cid	com															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf	s	s	s	s	s	s	s	s	s	s	s	cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 to 14 are used for returning the second part of the material name used in the meter for linearization. The name is divided into two parts to fit the space of 10 characters available for transfer. The first part consists of the first 10 characters maximum of the name and the second part consists of the rest if any. If all byte fields are in use there is no end marker. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string
- o 13. byte bi13: s(8) 9. character of string
- o 14. byte bi14: s(9) 10. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string transferred is 10 characters, there is no end marker. The name is constructed easily as a string from this data and possibly also from the first part. Usually, the material name is maximum 20 characters long in total.

Get the Current Library Name:

I7GLIBNM

29

0x1D

output data bo:

```

-----
|cid|com|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
-----
  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte

```

input data bi:

```

-----
|mw |mf |tw |tf | s | s | s | s | s | s | s | s |  |  |cid|sta|
-----
  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte

```

As a response to this request, the input fields, bytes 5 to 12 are used for returning the library name stored in the meter. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string transferred is 8 characters, there is no end marker. The library name is constructed easily as a string from this data. Usually, the library name is maximum 8 characters long.

Get the Meter's Identifier String 1:

I7TEST

10

0x0A

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf	s	s	s	s	s	s	s	s	s	s	cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

As a response to this request, the input fields, bytes 5 to 14 are used for returning the first part of the internal id string stored in the meter. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string
- o 13. byte bi13: s(8) 9. character of string
- o 14. byte bi14: s(9) 10. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string transferred is 10 characters, there is no end marker. The id string is constructed easily as a string from this data. Usually, the first id string describes the meter model.

Get the Meter's Identifier String 2:

I7TEST2

78

0x4E

output data bo:

```

-----
|cid|com|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
-----
  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte

```

input data bi:

```

-----
|mw |mf |tw |tf | s | s | s | s | s | s | s | s | s | s |cid|sta|
-----
  1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte

```

As a response to this request, the input fields, bytes 5 to 14 are used for returning the second part of the internal id string stored in the meter. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string
- o 13. byte bi13: s(8) 9. character of string
- o 14. byte bi14: s(9) 10. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string transferred is 10 characters, there is no end marker. The id string is constructed easily as a string from this data. Usually, the second id string describes the meter's embedded software version.

Get the Meter's Identifier String 3:

I7TEST3

80

0x50

output data bo:

cid com																

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw mf tw tf s s s s s s s s s s cid sta																

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 to 14 are used for returning the third part of the internal id string stored in the meter. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string
- o 13. byte bi13: s(8) 9. character of string
- o 14. byte bi14: s(9) 10. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string transferred is 10 characters, there is no end marker. The id string is constructed easily as a string from this data. Usually, the third id string describes the meter's serial number.

Get the Expansion Module Name:

I7GXNAME

110

0x6E

output data bo:

```

-----
|cid|com|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
-----
 1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte
input data bi:

```

```

-----
|mw |mf |tw |tf | s | s | s | s | s | s | s | s |  |  |cid|sta|
-----
 1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16   byte

```

As a response to this request, the input fields, bytes 5 to 12 are used for returning the expansion module name stored in the meter. The form of the input data (a string of characters) is the following:

- o 5. byte bi5: s(0) 1. character of string
- o 6. byte bi6: s(1) 2. character of string
- o 7. byte bi7: s(2) 3. character of string
- o 8. byte bi8: s(3) 4. character of string
- o 9. byte bi9: s(4) 5. character of string
- o 10. byte bi10: s(5) 6. character of string
- o 11. byte bi11: s(6) 7. character of string
- o 12. byte bi12: s(7) 8. character of string

- o xx. byte bixx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data must be ignored. If the total length of the string transferred is 8 characters, there is no end marker. The name is constructed easily as a string from this data. The module name is maximum 8 characters long. The name is factory set when the module is installed to the meter. It's existence is shown in status3 also. The name is a short description of what the module does. It may be a special measuring unit or it may have some other purpose.

Set the Current Library Name:

I7SLIBNM

30

0x1E

output data bo:

cid	com	0		0		s		s		s		s		s	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

The meter's library name is changed with this command. The output fields used are as follows:

- o 3. byte bo3: 0
- o 4. byte bo4: 0
- o 5. byte bo5: s(0) 1. character of string
- o 6. byte bo6: s(1) 2. character of string
- o 7. byte bo7: s(2) 3. character of string
- o 8. byte bo8: s(3) 4. character of string
- o 9. byte bo9: s(4) 5. character of string
- o 10. byte bo10: s(5) 6. character of string
- o 11. byte bo11: s(6) 7. character of string
- o 12. byte bo12: s(7) 8. character of string
- o 13. byte bo13: s(8) end marker character of string. ASCII 0
- o xx. byte boxx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data will be ignored. You can fill in the rest of the output bytes with zero. The library name is maximum 8 characters long.

Set the Unit for Moisture:

I7SUNIT

12

0x0C

output data bo:

cid	com	0		0		s		s		s		s		s	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

The measuring unit is changed with this command. The output fields used are as follows:

- o 3. byte bo3: 0
- o 4. byte bo4: 0
- o 5. byte bo5: s(0) 1. character of string
- o 6. byte bo6: s(1) 2. character of string
- o 7. byte bo7: s(2) 3. character of string
- o 8. byte bo8: s(3) 4. character of string
- o 9. byte bo9: s(4) 5. character of string
- o 10. byte bo10: s(5) 6. character of string
- o 11. byte bo11: s(6) end marker character of string. ASCII 0

- o xx. byte boxx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data will be ignored. The unit is maximum 6 characters long. Note that the unit does not affect the resulting moisture value in any way. It is displayed in Keyboard mode only in the PC program's screen. It works as a reminder in special cases.

Set a Material Name, part 1:

I7SMATNM

81

0x51

```
output data bo:
```

cid	com	0		0		s		s		s		s		s		s		s		s		s		s					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte													
input data bi:																													
mw	mf	tw	tf																						cid	sta			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte													

The name of a material entry is changed with this command. Only the first 10 characters of the name are transferred. The output fields used are as follows:

- o 3. byte bo3: entry # (1...100)
- o 4. byte bo4: 0
- o 5. byte bo5: s(0) 1. character of string
- o 6. byte bo6: s(1) 2. character of string
- o 7. byte bo7: s(2) 3. character of string
- o 8. byte bo8: s(3) 4. character of string
- o 9. byte bo9: s(4) 5. character of string
- o 10. byte bo10: s(5) 6. character of string
- o 11. byte bo11: s(6) 7. character of string
- o 12. byte bo12: s(7) 8. character of string
- o 13. byte bo13: s(8) 9. character of string
- o 14. byte bo14: s(9) 10. character of string

- o xx. byte boxx: s(x) end marker character of string. ASCII 0

The end marker may be at any position indicating the actual length of the string. In that case, the rest of the data will be ignored. The material name (part 1) is maximum 10 characters long. If the 10 characters are all used, no end marker is required. The second part is sent with another command and the strings are patched automatically. Note that this command goes as the first command, else an incorrect patching will be done.

Set a Material Name, Part 2:

Get the LAN Addresses:**I7GLAN 84 0x54**

output data bo:

cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

input data bi:

mw	mf	tw	tf	i	i	i	i									cid	sta
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		byte

As a response to this request, the input fields, bytes 5 to 8 are used for returning the master and slave addresses used in the RS485-based Local Area Network. The form of the input data is the following:

- o 5. byte bi5: 0
- o 6. byte bi6: master address (0...255)
- o 7. byte bi7: 0
- o 8. byte bi8: slave address (0...255)

With this command you can check the addresses if troubleshooting is required for your second network.

Set the LAN Addresses:

I7SLAN

85

0x55

output data bo:

cid	com				i	i	i	i							

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
input data bi:															

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
byte															

The output fields used are as follows:

- o 5. byte bo5: 0
- o 6. byte bo6: master address (0...255)
- o 7. byte bo7: 0
- o 8. byte bo8: slave address (0...255)

With this command you can set the addresses for your second network. The default addresses are 0 for Master and 1 for Slave.

Initialize the Profibus DP slave:

I7DPINIT 65 0x41

output data bo:

cid	com															

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

input data bi:

mw	mf	tw	tf											cid	sta	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

This will initialize the slave. Note that it will also be incapable of responding to DP master while initializing all SW and HW subsystems (< 1 second).

Send a Short Pulse to the LED Indicator (if available on the connector panel):

I7BEEP 34 0x22

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----

byte

This command will flash once the indicator lamp on the back panel of the meter.

Start Fast Fourier Transform in the Meter:

I7FFT

83

0x53

output data bo:

cid	com														

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

input data bi:

mw	mf	tw	tf											cid	sta

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
															byte

The meter's own FFT routine is started with this command. It is a fixed 1024 samples' transform and it uses the contents of Bank1. While performing it, it needs the space of the other banks, Bank2, Bank3, and Bank4. The long Series is not touched during that process. The conversion will take usually less than ten seconds and the resulting power spectrum will be placed into Bank1. The spectrum is not flattened with logarithm, it is linear. One can use it if the Advanced PC program is not available or there are no frequency domain algorithms available in your **Profibus DP** development tool. The data from Bank1 can then be downloaded to your DP Master for further analysis and display.

Get the Expansion Module Number:

I7GNXMOD

109

0x6D

output data bo:

cid	com																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte	

input data bi:

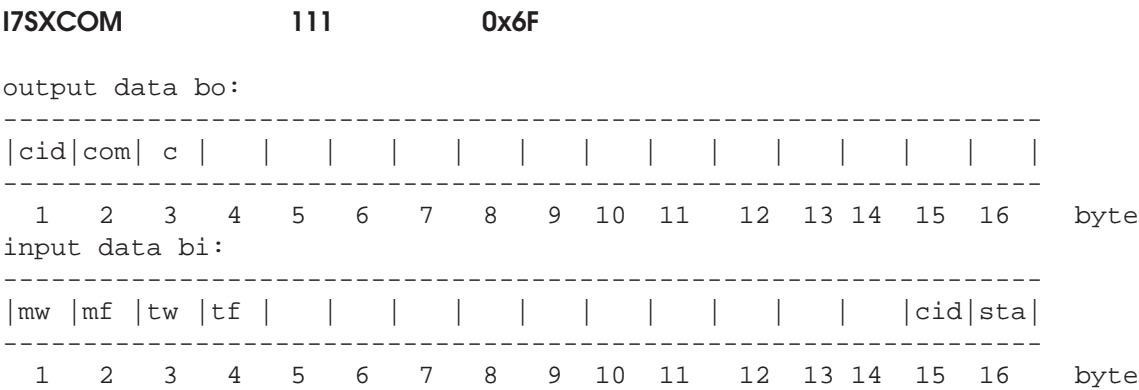
mw	mf	tw	tf	i	i								cid	sta		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	byte

As a response to this request, the input fields, bytes 5 and 6 are used for returning the number of the expansion module connected to this meter. The form of the input data is the following:

- o 5. byte bi5: high byte of count = 0
- o 6. byte bi6: low byte of count = unsigned character 0...255 module number

The number is factory set when the module is installed to the meter. It's existence is shown in status3 also. The number is a condensed description of the type of the module and gives the acquisition system instructions on how to handle the associated data. The module may be a special measuring unit or it may have some other purpose.

Send a Command to the Expansion Module:



The output fields used are as follows:

o 3. byte bo3:		having values:	
symbol		dec. value	hex. value

command		0...255	0x00...0xFF

The **command** will be directly transferred to the expansion module without any filtering, interpretation or waiting for a reply. There is only a simple protocol associated with this, no actual error checking. The module may be a special measuring unit or it may have some other purpose. If error checking or command accepting response is required by the expansion module, it will respond by the signal it transmits. That is interpreted at the highest level to make sure the command was accepted without errors. Refer to the expansion module's own User's Guide for details about its commands, if any are available. If no expansion module is installed to **AK50**, the commands have no effect.

Appendix 1. A Sample Database Text File for DP Slave Configuration

This data file is included on your program diskette as IRMA7416.TXT and as a binary loadable database IRMA7416.LDB.

```
@DB_TYP CP5412A2 V1.0
@LANGUAGE ENGLISH
#NCMCV_CONVERTER V1.0 ASCII-OUTPUT
##DB_Ident_ID = 0 # constant
##versionStr = "@@DB_TYP CP5412A2 V1.0 DEUTSCH DOS" # constant
# creator = "UNKNOWN" # default
##SystemSDBBlockId = 121 # constant

SystemSDB
{
    SDBParameterblock
    {
        ##PblkNo1 = 1
# constant
        ##PblkVersion1 = 0
# constant
        # LocalEdit = "TRUE"
# default
        MaxMaster = 1
        BusParCalculate = "dpmono"
        # ProfileType = 0
# default
        MaxSlave = 2
        ##PblkNo2 = 2
# constant
        ##PblkVersion2 = 0
# constant
        Hsa = 126
        Ts = 2
        # StationType = "ACTIVE"
# default
        BaudRate = "1500.0"
        ##MediumRed = 0
# constant
        RetryCtr = 1
        DefaultSap = 52
        NetwkConSap = 53
        Tsl = 300
        Tqui = 0
        Tset = 1
        MinTsdr = 11
        MaxTsdr = 150
        Ttr = 1000000
        G = 10
        ##InRingDesired = 1
    }
}
```

```

# constant
    ##PhysLayer          = 0
# constant
    ##SblkNo5            = 5
# constant
    ##SblkVersion5       = 0
# constant
    }
}
##DpSdbBlockId          = 128                                # constant

DpSDB
{
    SDBParameterblock
    {
        ##PblkDpMgt      = 1
# constant
        ##PblkVersion    = 0
# constant
        ##DpManagementLEN = 37
# constant
        # CtrPollToResetStatLst = 1
# default
        DataControlTime    = 60
        MasterPollTimeout  = 2
        # Master2PollTimeout = 200
# default
        MasterGsdFile      = "CP3425DP.GSD"
        reservedWdTimeout  = 10
        ClearDP             = "FALSE"
        zyklGlobalCtrlCommand = "NONE"
        bWdDefault          = "TRUE"
        ##ReservedDp        = 0b0000
# constant
        # zyklGlobalCtrlGrpIdent = 0
# default
        maxMinSlvIntervall = 5
        DpDelayTime        = 5

        NormSlave
        {
            ##PblkDpMgt      = 2
# constant
            ##PblkVersion    = 0
# constant
            SlvAdr            = 3
            ##NormSlaveKey    = 0
# constant
            SlvName           = "AK50 Moisture meter"
            GsdFile           = "IRMA7D04.GSD"

```

```

        MinSlvIntervall    = 50
# SlvActivate              = "Activated"
# default
# ActivatedSlvMode        = "SlvDataExchange"
# default
# DeActivatedSlvMode      = "SlvDoNothing"
# default
# Passiv                  = "Active"
# default
##Reserved                = 0b00
# constant
##Reserved1              = 0b000
# constant
        Watchdog           = "On"
        FreezeMode         = "Off"
        SyncMode           = "Off"
##MstAccess               = 0b01
# constant
        WdFact1            = 1
        WdFact2            = 10
        MinTsdr            = 11
        IdentNumber        = 0x08
        GrpIdent           = 0x00
        OutLenAll          = 16
        InLenAll           = 16

ModEntry
{
        ModType             = "Moisture/temp./data"
        OutBegin            = 0
        InBegin             = 0
}

ModEntry
{
        ModType             = "Moisture/temp./data"
        OutBegin            = 0
        InBegin             = 0
}

Module
{
        SimpleModDescr
        {
                IoLen         = 0b1111
                IoType        = "Input"
                Alignment      = "Byte"
                Consistency    = "Value"
        }
}

```

```
Module
{
    SimpleModDescr
    {
        IoLen           = 0b1111
        IoType          = "Output"
        Alignment       = "Byte"
        Consistency     = "Value"
    }
}
}
}
}
```

Appendix 2. A Sample GSD Data File for DP Slave Configuration

This GSD data file is included on your program diskette as IRMA7D04.GSD. Note that the earlier GSD file is for slaves with ID = 0. Now the ID = 8 until a final ID is received. To adapt to the new number requires only changing one field in the file. The latest internal software allows also the changing of the unit's own ID.

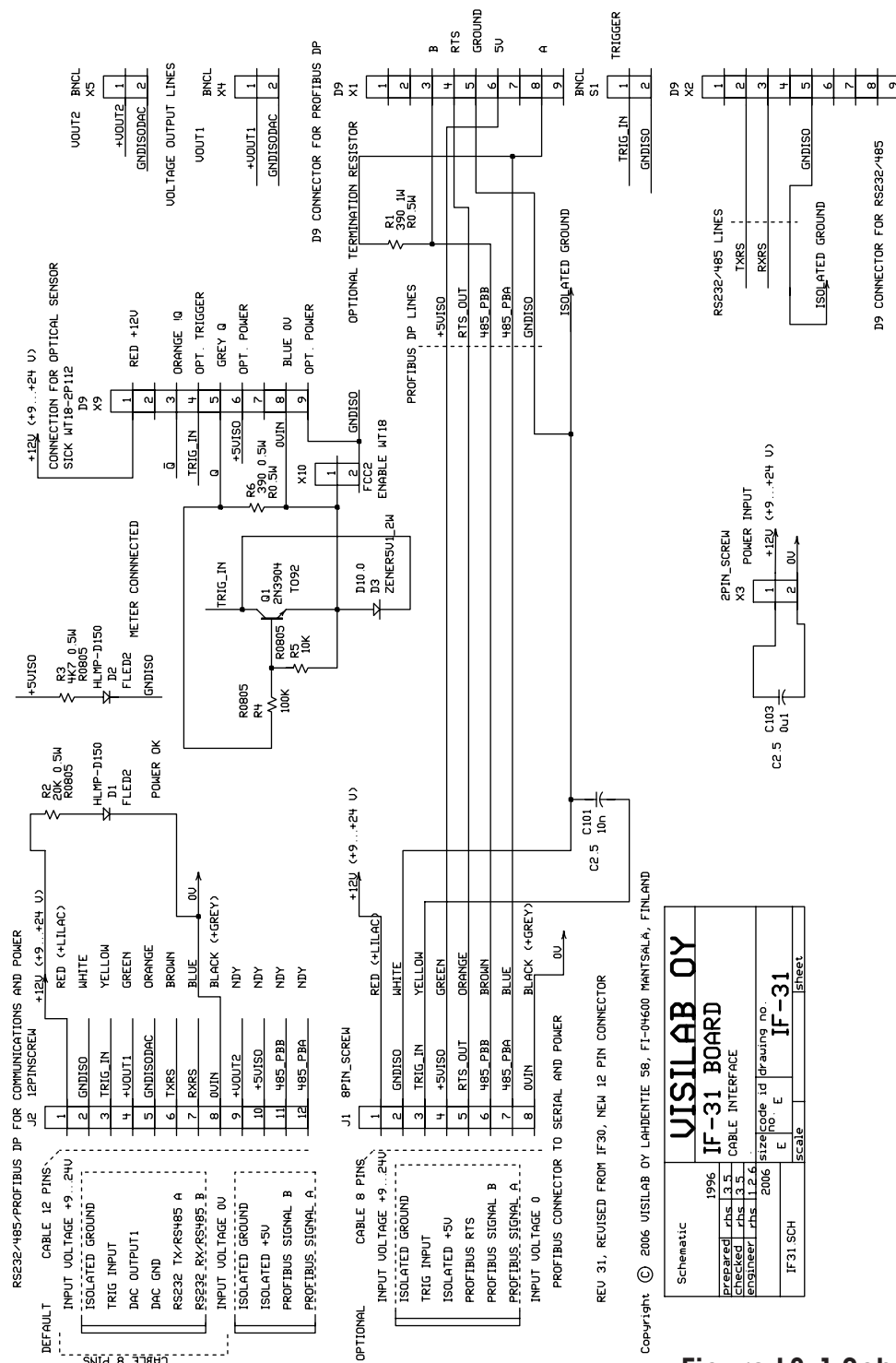
```
;
;
; Description of a DP slave. Lines beginning with a semicolon are
; comments only.
;=====
; GSD-Data for AK50                      Visilab Signal Technologies Oy
;                                     Vantaa, Finland
; Vers. : V1.02 -      Mr. H. Stenlund Tel. +358-45-6354885
; AK50 is a fast on-line surface moisture meter for
; measuring paper, board and other substances.
; It supports all rates from 9600 bauds to 12 Mbauds.
; The RTS signal is available at TTL level. It also has an
; isolated +5V pin on the D9 connector supplying some 50mA max.
; The address can be changed by the master.
; Rev. History: V1.01 The Ident-Number was changed to 0x00008
;                V1.02 the IO structure was changed to 16 bytes in/out with
;                full compatibility with old systems. Use this
;                GSD file for the 16/16 bytes and the old irma7d03.gsd for the
;                4/4 bytes IO. All old commands are supported with no changes.
;=====
; General parameters
#Profibus_DP
Vendor_Name = "Visilab Signal Technologies"
Model_Name = "AK50 Moisture meter - Rev5K"
Revision = "Version 2"
Ident_Number = 0x0008
Protocol_Ident = 0
; 0=Slave, 1=Master (Class 1)
Station_Type = 0
; 0=DP only, 1=DP and FMS
FMS_supp = 0
Hardware_Release = "A01"
Software_Release = "Z02"
9.6_supp = 1
```

```
19.2_supp = 1
93.75_supp = 1
187.5_supp = 1
500_supp = 1
1.5M_supp = 1
3M_supp = 1
6M_supp = 1
12M_supp = 1
MaxTsdr_9.6 = 60
MaxTsdr_19.2 = 60
MaxTsdr_93.75 = 60
MaxTsdr_187.5 = 60
MaxTsdr_500 = 100
MaxTsdr_1.5M = 150
MaxTsdr_3M = 250
MaxTsdr_6M = 450
MaxTsdr_12M = 800
Redundancy = 0
; RTS-Signal (CNTR-P) Pin 4 9-pin SUB-D
; 0-not available, 1-RS485, 2-TTL
Repeater_Ctrl_Sig = 2
; 24V Pin in 9-pin. SUB-D
; 0-none, 1-RS485, 2-TTL
24V_Pins = 0
Implementation_Type="SPC3"
Bitmap_Device="DP_NORM"
orderNumber="AK50"
;
;--Slave specific values-----
;
; Freeze Mode
Freeze_Mode_supp = 0
; Sync Mode
Sync_Mode_supp = 0
; Autom. Baud rate search
Auto_Baud_supp = 1
; Address is changeable
Set_Slave_Add_supp = 1
;unsigned 8
User_Prm_Data_Len = 0x0
User_Prm_Data =
; Slave unsigned 16 (Basis 100us), 5 ms
Min_Slave_Intervall = 0x0032
```



```
Modular_Station = 1
Max_Module = 0x01
Max_Input_Len = 0x20
Max_Output_Len = 0x20
Max_Data_Len = 0x0040
; Module, 16 bytes in, 16 bytes out
Module= "Moisture/temperature/data in, command/data out" 0x1F,0x2F
EndModule
```

Appendix 3. Schematic of Electrical Connections for Model D in the connection box. **If you open the distribution boxes cover, please, disconnect the power lead first to avoid a shock!** Find below a schematic for wiring of the circuit board inside the power supply -PS. On the next page, find a corresponding component placement drawing. You can find more information from the model -PS Operating guide.



Schematic	1996
prepared rts	12.5
checked rts	13.5
engineer rts	12.6
IF-31	size/code id drawing no.
E	no. E
scale	1:1
sheet	1

Figure L3-1 Schematic of the circuit board in the model -PS power supply unit

Appendix 4. Procedure for Passing Commands to the Slave

The procedure for sending any of these commands is the following. The default command that should normally be sent to a slave, consists of zeros only. That will make it sure that no pending commands are processed. Note that it is required to send the command **only once** to a slave. Sending a command repeatedly will redo the same thing and possibly overload the slave. For simplicity, in the following the command identifier **cid** is left as zero.

For that reason you have to go along the following lines to communicate with the slave, independent of the type of the master and the user interface attached to it.

step	command bytes		bo3	bo4 and rest of bytes	action
	bo1	bo2			
1.	0	0	0	0	default, no action taken
2.	0	0	data	data	no action taken
3.	0	command	data	data	command performed
4.	0	0	data	data	no action taken
5.	0	0	0	0	default, no action taken

In this way you will prevent sending incorrectly interpreted or duplicated commands. Zero commands are simply ignored. The problematic commands are:

	bo1	bo2	bo3 and rest of bytes
n.	0	command	undefined data
and:			
n+1.	0	command	real data
n+2.	0	command	real data
n+3.	0	command	real data
n+4.	0	command	real data (an accidentally repeated command)

In the first case (step n.) the data part is not yet defined and this may lead to unexpected results, like to changing to work with an empty calibration table. The next command (step n+1.) is repeated infinitely until replaced with another. That will cause possibly overloading of the slave and decreases the response times.

If you are sure that your master is able to send the command output data as a single operation, like step 3. above, then you can apply the commands as such without the intermediate steps 2. and 4.

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