EN

Competence in Solids

SWR engineering

IDG 100

Dust monitoring for internal areas

Software Instructions

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1. INTRODUCTION

IDG 100 software maual describes parameters and functions of IDG 100 product that can be accessed with PC via RS485 terminal connection.

2. WIRING

Before IDG 100 is accessable, device must be connected at least to a power source and RS 485 bus.

Required voltage for Dumo is 24 VDC and unit comes with two meter power and signal cable ready connected. Connect the power supply to grey(-) and pink(+) wires.

There are 4 pairs (8 wires) in the same cable, two wires for power supply, two for relays, one for mAsignal and one for remote automatic setup.

Blue and Red wires are for relays. Blue or Red gives the sarne voltage as power voltage is, when relay latches. Both relays must be connected to zero voltage (= OV) with another wire.

2.1. Cable signals by colour

(1)	Colour WHITE	RS- (RS-485)
(2)	Colour BROWN	RS+ (RS-485)
(3)	Colour GREEN	Automatic setu (when connected to V-)
(4)	Colour YELLOW	4…20 MA signal source with V-
(5)	Colour GREY	V- (GND / 0 V)
(6)	Colour PINK	V+ (24 VDC)
(7)	Colour BLUE	relay 1 V (24 VDC, Imax = 170 mA
(8)	Colour RED	relay 2 V (24 VDC, Imax = 170 mA

3. SOFTWARE MANUAL

This Software rnanual presents information about DUMO (DUST24_0911) Software version 1.3.2 parameters and functions.

3.1. Measurement

Dust measurement calculation is done in three consecutive phases. Functions of these phases can be controlled with [DV] and [TC] parameter values.

3.1.1. First phase

First phase is based on raw data buffer calculations. Data is harvested from raw data stack, which holds last 10 raw data values (ca. 1,5 sec).

The average value of data buffer is calculated after [DVI percentage (%) of highest values are rejected. DV vatue must be between 0 ... 100.

3.1.2. Second phase

In second phase data is averaged over time of [TC] second4 See oppendix D about the behaviour and effect of TC value.

3.1.3. Third phase

Zero correctiori is the last method done just before data is released. Value of [ZCI is simply subtracted frorn data value.
The result of subtraction is how ever never negative, but zero.

3.2. Connected with terminal software

To connect with device, rs485 adapter and terminal software with ***vt100, ANSIW*** or ***ANSI*** emulation is needed. During 3 first seconds after bootup there must be no traffic in RS485 bus or device's command line service is disabled and no data is sent to rs485 bus. This is done to prevent interfering with existing bus activity.
In case of no bus traffic during first 3 seconds after boot, the power led turns off for 0,5 seconds and the device requests status information once from terminal with "ESC [5 n" status request string. If terminal software responds with standard status information string "ESC [0 n" the command line service is activated. Otherwise terminal access is disabled until next bootup.

Parameters for rs485 connection are:
- 38400 baud
- 8data bits
- No parity bit
- 1 stop bit
- No flow control

3.3. Command line command

Arguments marked with () are optiorial arid/or used witfi specific pararmeters only. Parameters marked with [] contains the list of reserved directives separated with / char.

$value and *$str* describes user determined content: numbers and text strings.

3.3.1. Notes

- To enter CMDline mode press SPACE to exit type commandd exit and press enter.
- Possible command abbreviations are underlined.

Command Name	Arguments	Info
help	($str)	Prints out command list. With optional argument $str, help about specific command or parameter can be requested. Not all parameters are covered with internal help.
cls		Clear screen.
parameters		Prints out control parameter table.
cable		Print cable signal chart
calib	[mal/mah/man] $value [info] $str	mA-output calibration. With info parameter, 19 char calibration info string can be stored to eeprom. mal = mA Low (4mA) mah = mA High (20mA) man = mA Notify (22mA) Note: When calibration is set, mA-output is forced to calib point value for test measurement. To release output for measurement engine, close terminal or use ***set ma auto*** command.
echo / @	[off/on/onwitheesave] (prof slot nro) ($str)	Sets terminal character echoing on or off. During off state ee-memory cannot be written. Using parameter *onwitheesave* echo is set to *on* mode and eeprom-memory is written current version, login and calib info and profile is saved if slot (and/or) name is given. Single '@' character as a first character on command line, sets echo off. This can be used in the first line of script to turn echo off for the rest of the script.
led	(g/o/r/f/b/n)	Sets indicator led to *green, orange, red, off, blinking or normal* state accordingly. Without any parameters, returns current indicator led color.
log	[start] $srt [stop/clear/ indetail]	Log keeps statistics about data. Log is started on every bootup and stopped, when log is full or stopped. With *log in detail* vector of 102 separate segments prints. On *Log start* additional info string can be given, with max length of 29 char.
login	[activate/disable] $str	Activates password query on Command terminal login. Password can be up to 8 characters long and it is case sensitive. ****** Overriding passwd needs factory reprogramming! ******

relay	define function: [l/a/b] [g/r/o/f] [1/0] [1/0] set relays: [1/0] [1/0] unlock manual set: [auto] set time hysteresis: [htime] $value	Handles relay and indicator behaviour **for current profile**. Allows also user to manually set the state of both relays. Without parameters prints out current relay status sheet. There are four parameter sequences to choose from: Set behaviour of led indicator and both relays in three states divided by L1 and L2 values as follows: L-mode happens when signal is [0;L1[A-mode happens when signal is (L1,L2[B-mode happens when signal is [L2,max] Syntax: *relay <state> <led> <relay1> <relay2>* Sets Relay 1 and Relay 2 to desired values (1=ON and 0=OFF). Values for both relays must be given in order to lock relays manually to desired state. *Syntax: relay <relay1 state> <relay 2 state>* To unlock manually set relay state, give parameter *auto (*or exit command line terminal). Minimum time for relays to freeze after any change can occur again. Value can be set up to 25 seconds.
run	[ma/test/button/cancel] ($phase time) ($additional value)	Run predefined procedure. *cancel* terminates running procedure on its tracks**, reverting back to profile 0 parameters.** Procedure can be cancelled by pressing button the second time. Phase time is 10 sec, unless optional parameter $value1 defines a custom phase time in seconds.
dataprint	[on/off] [time]/[temp] [on]/[off] [delay] $value	Set data, time and temp columns printing ON or OFF during off-command line operation. State will be saved with profiles and with *dataprint off* mode no welcome screen will be printed. Delay gives print out only every $value seconds. If delay is used TC should be set accordingly not to loose data.
set	[param] $value/$str	Set parameter to given value. (See appendix B)
time		Shows RTC-time counter, which is different from log time counter. Time can be set with *set time d h m s*.
temp		Shows on board temperature in Celsius [C].
prof	[load/save/del] $value ($str)	**Parameters**, **dataprint** and **relay** behaviour can be saved under named profile. Ten different profiles (0…9) can be saved in device. *After power down device will forget all not saved parameters and substitute them with factory parameters, unless profile 0 has parameters saved into it.*
exit		Close command line interface.
ver	(tst) / (prg)	Prints out device name. With tst parameter factory test information is viewed, with prg software version is printed.

3.4. Direct commands

When software runs in non-command line mode (default) commands can be given with single key press. These commands toggle the printing of predefined columns *on* or *off*.

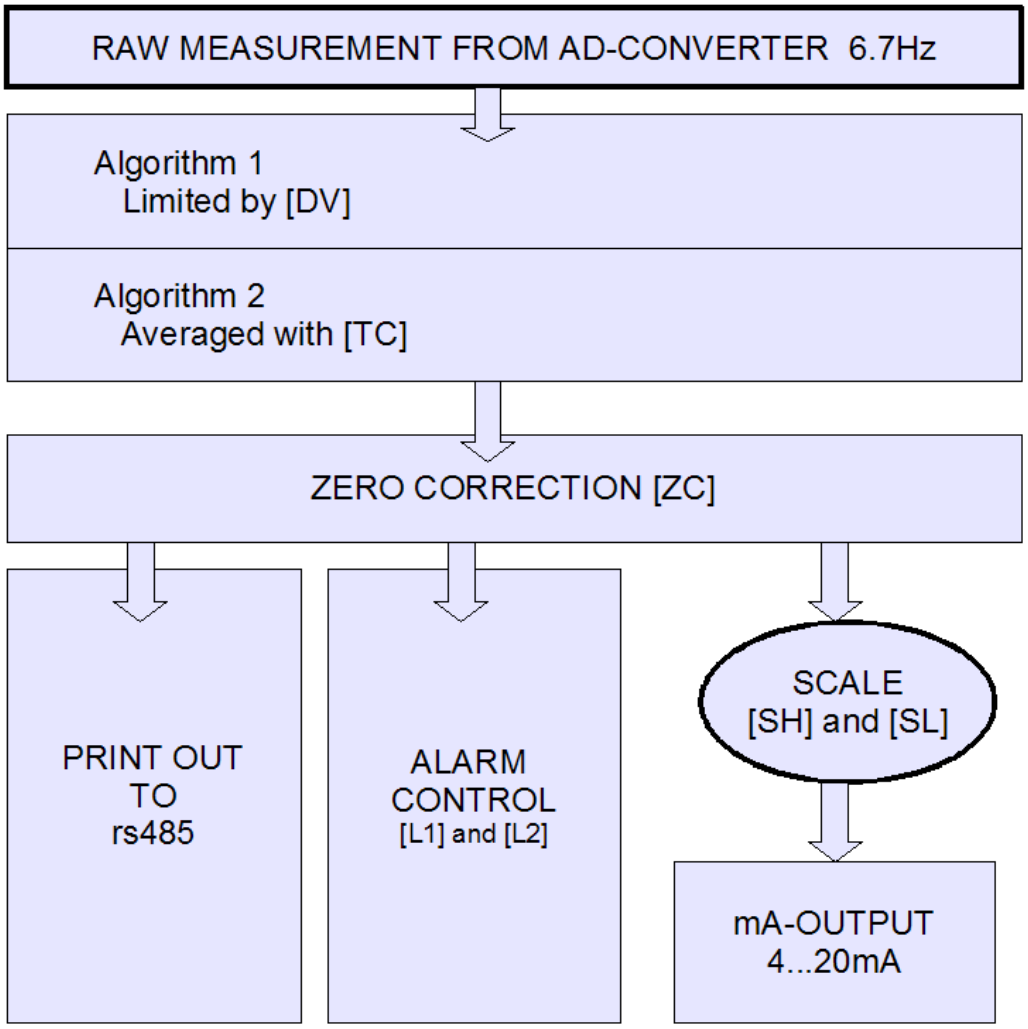
Direct command	Info
o	Toggle data output to rs485 ON and OFF. Example: **1256,L** Separated character designates alarm level. Levels are L, A and B. See relay command for more information.
t	Toggle time stamping column ON and OFF. Example: **0 days,00:47:54,140**
h	Toggle temperature [C] column ON and OFF. Example: **+ 22.1**
m	Prints out mA-output level, unless mA-output is disabled with *set ma 0* command. Example: **12.7**
1	Prints out raw data measurement value from ADC without any calculation.
<SPACE>	Enter command line mode. This interrupts also data output printing to rs485

3.4.1. Note

Direct commands are functional even if the access to command line mode is locked with password.

Command line must be activated by the presence of terminal interface during unit's bootup with "ESC [0 n" respond string to use any of these commands.

4. APPENDIX A – MEASUREMENT PHASES



5. APPENDIX B – CONTROL PARAMETERS

Measurement is controlled by environmental variables called parameters. These parameters are handled with *set* command. Parameter list can be printed out with *param* –command

5.1. NOTE

Parameters below, along with relay behavior and dataprint settings, can be named and saved for later use with *prof* command.

Parameter	Description
zc/ZC $value	*Zero Correction* value is subtracted after ALG2 and effects L1 and L2 calculation.
dv/DV $value	*Delete Value* determines how many values out of ALG1 buffer[10] are rejected before ALG2 average and change calculations. Value can be in range of [0,100]% [DV] is designed to kill the effect of short spikes in avg calculation.
tc/TC $value	*Time coefficient* determines in seconds how long time is used in running average calculation in phase ALG2.
sl/SL $value	*Scale low* is the low end of scale window. Scale is used by mA output calculation.
sh/SH $value	*Scale high* is the high end of scale window. Scale is used by mA output calculation.
l1/L1 $value	*Limit 1* sets boundary between relay modes L and A.
l2/L2 $value	*Limit 2* boundary between relay modes A and B.
ma/MA $value	Forces mA-output to desired value=[40,200] describing tenth of mA value. (Example: value 83 corresponds to 8.3 mA) Value *0* disables mA output until the next boot up or user command. Value *auto* releases manual override back to measurement service. Value *notify* sets to 120% (22mA) for error or notify purpose.
mdqt/MDQT $value	In some conditions it is known to happen, that heavy rs485 traffic may disturb the sensitivity of the measurement. *Measurement DisQualify Time* allows user to set up time window in 1/10 of seconds, during which the dust measurement is not done in order to prevent any interference. Note1: MDQ- time is not included in TC time. Much traffic will delay measurement and result in longer TC time as expected. Note2: Heavy traffic together with MDQT-time set other than zero, may even prevent any measurement from happening.
time (d) (h) (m) (s)	Set internal time counter. Parameters are: d=days, h=hour, m=min and s=seconds. At the moment of set, milliseconds are set to zero as well as any not given parameters.

6. APPENDIX C – PROCEDURE DESCRIPTIONS

Software includes three different predefined procedures: *test, button* and *ma*. These procedures are activated by command line using *run* command, except the *button* procedure which can be activated by using on board button (or via standard cable button signal).

During any procedure, normal actions will change and depending on selected procedure, measurement parameters will be altered.

6.1. MA - procedure

Device will run mA-output signal from 0% to 100% and back to 0% with 20% steps. Each step will take default procedure time (10sec), unless custom time is given as an optional parameter as argument with *run* command.

Initialization and exit phases of MA procedure will take 2 seconds during which time mA-output is disabled (0mA --> -15%)

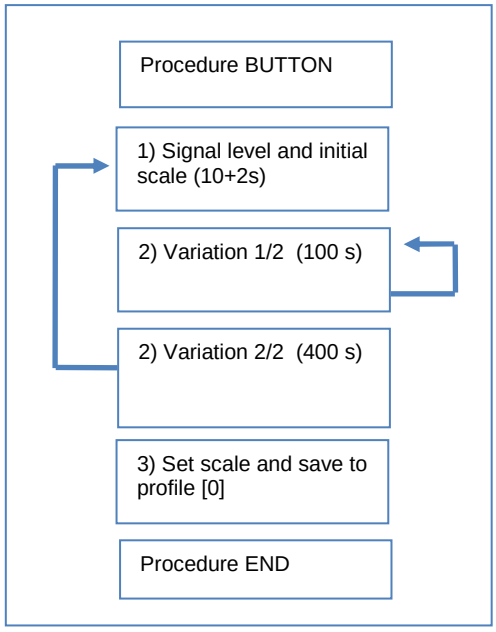
Procedure MA is intended for mA-output accuracy and linearity testing.

6.2. Button - procedure

Use BUTTON-procedure to calibrate measurement parameters. During calibration indicator blinks green by default. BUTTON- Procedure can be ctivated with:

- on board button
- cable signal
- using command line terminal *run* command: *run button (phase 2 total time in seconds) (mA level [40…120]ie. 100x…2x)*

When activated by button, no optional parameters are given and procedure is run in default values: "***run button 500 48"***



6.2.1. Phase 1 - Initial signal level and scale

First phase detects current signal level using 10+2 second measurement phase with TC=5s and DV=20% running average calculation.
Scale is set for next phase so, that signal average should hit 5% (4,8mA) level on the scale.

6.2.2. Phase 2 - Two phase variation study

Second phase will study signal behavior over time during two stages with TC=1s and DV=20%.

In Variation 1/2 phase signal is studied initial 100 sec or 25% of custom time to ensure it being within set scale, before longer study is run. If signal does not stay within scale, scale is expanded iteratively, until study shows signal staying securely (with 95% coverage) within scale. This iteration changes indicator to blinking orange. If stage is passed, indicator is set to blink green.

In Variation 2/2 signal is studied 75% of the custom time or default 400 sec. To pass this stage, signal must stay within scale with 95% of coverage. Otherwise indicator is turned red and signal level (Phase 1) measurement is restarted all over again.

6.2.3. Phase 3 - Set parameters

In this stage the phase measurement parameters are set and stored into profile [0]. Relay behaviour is set to default according TEST-procedure states.
Any data in profile slot [0] is overwritten.

Scale is also modified so, that the scale point is set is to 5% ie. 8mA unless scale must be extended due to high spikes in signal during autosetup.

Measurement parameters are set as follows:

DV = 20 %	TC = 5 sec	ZC = 0
SL = 0	SH = <Default 20x signal level. Custom value range if 100x…2x ie 40…120 as tenth of mA values >	
L1 = 25% of Scale	L2 = 100% of Scale	
MDQT = 0,2s	Dataprint delay = 1,0 sec	Dataprint mode = ON

6.2.4. Notes

Procedure alters measurement parameters, saves new parameters over profile [0] and cancels possible previous data logging.

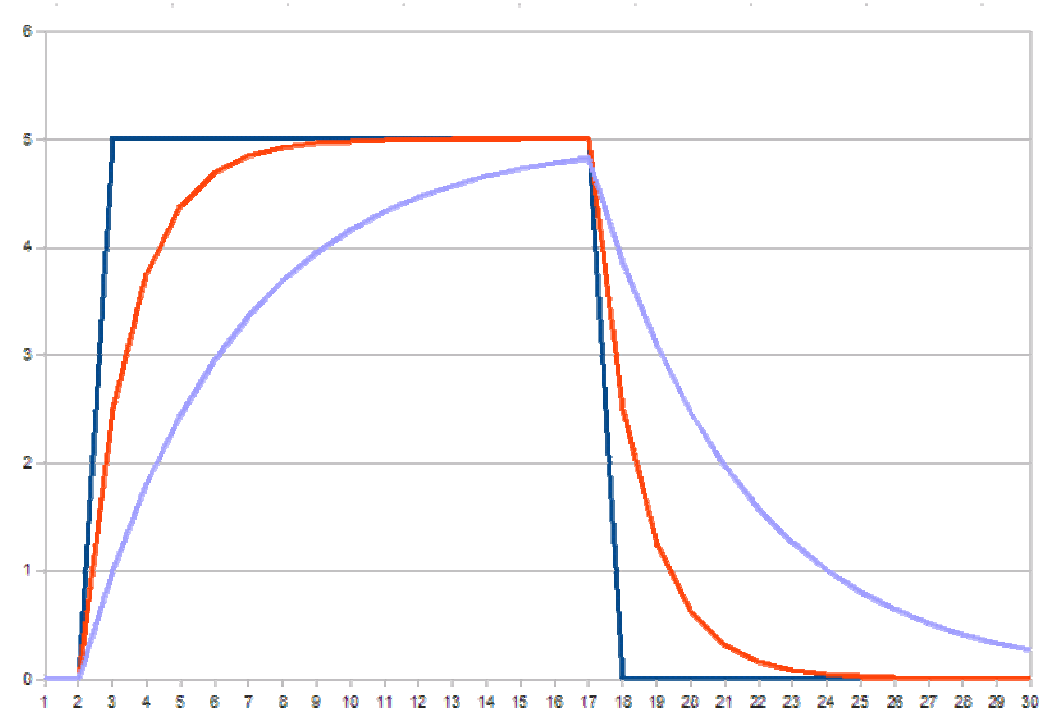
6.3. Test - procedure

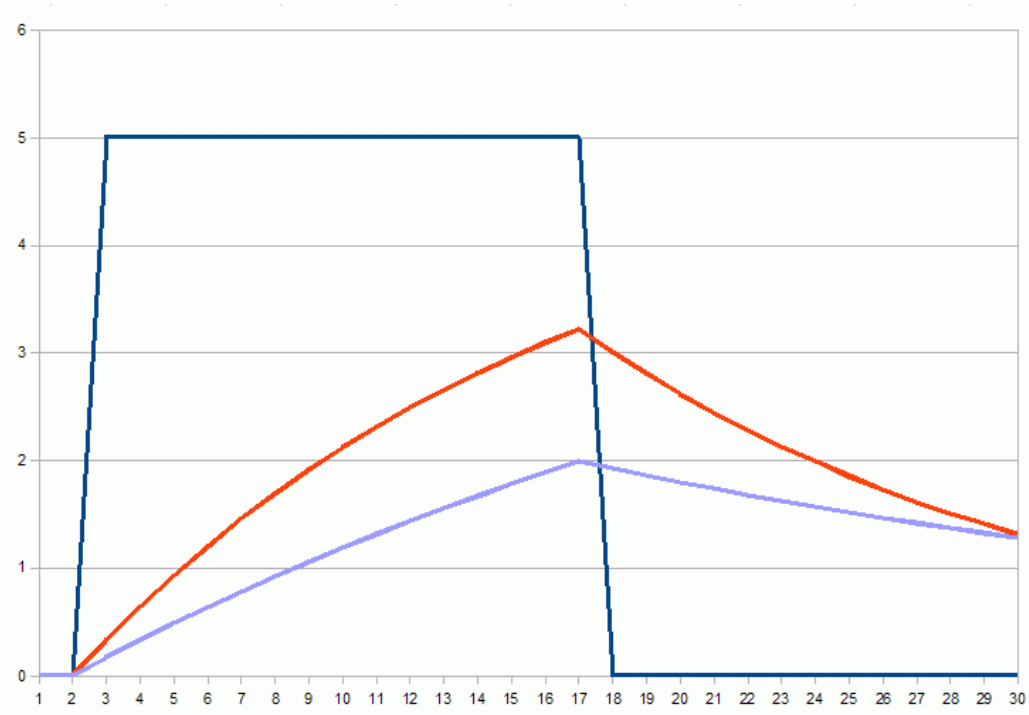
Procedure is intended for output testing. It will run predefined output stages to allow fluent output signal measurements during production test.

Phase	Time[s]	LED	Relay 1	Relay 2	mA-output
init	2	OFF	OFF	OFF	OFF
1.	stime	GREEN	OFF	OFF	4.0mA 0% U(250R)=1.0V
2.	stime	ORANGE	ON	OFF	12.0mA 50% U(250R)=3.0V
3.	stime	RED	ON	ON	20.0mA 100% U(250R)=5.0V
end	2	OFF	OFF	OFF	OFF

7. APPENDIX D – SELECTING MOST APPROPRIATE TC-VALUE

TC-value counts general dust level over defined time. Setting appropriate time as TC-value depends on required signal damping factor and how fast respond is required.
Below is a presentation of TC values 2, 5, 15 and 30 over time of 15 seconds. Behavior is similar with longer time periods.





8. APPENDIX E – USING SCRIPTS

Device parameters can be set by using scripts. Script is basically a single text file, where all the normal commands are typed as they were typed in a command line interface manually. Then this file is sent to device using terminal software. This sends all the characters in file as a consecutive stream of characters.

Script is an easy way to set up multiple parameters or multiple devices at once to desired working state.

8.1. Technical issues to remember

Since script characters are sent in a row without any delay there is two things to consider:

Device has no time between characters to echo them back as would happen, when typed normally. This is a technical limitation of RS485 bus interface not being full duplex. To enable such fast speed character echoing must be disabled with '@' character as a first char in script file or by hand typing "echo off" before sending file.

During command sequence, there is no time to save any information to internal non-volatile eeprom memory. This save procedure can be initiated as a last action in script file with special echo command parameters. In stead of "echo on" command as a last command in script file, use special parameter: "*echo onwitheesave*" this will store acquired information into eeprom memory and restore echoing.

To save measuring parameters to desired slot as well one can give slot number and slot name as additional two parameters also: "*echo onwitheesave 3 My Slot of Parameters*"

Here's an example of one possible script file:

```
@
set sh 100000
set sl 0
set l1 50000
set l2 100000
set tc 25
set zc 0
calib info mA not calibrated
set dv 9
echo onwitheesave 0 Factory Default
```