User & Maintenance MANUAL

Slurry Density and Slurry Massflow Analyzer / Easidens

Doc No: KWR-7QA03-901-220112-EN
For Software Version KWR-7QA03-517-211216LM/GP/GPW

Thank you for purchasing and using

Arenal's Slurry Density Analyzer for continuous monitoring of Specific Gravity, Density, Total Suspended Solids and temperature of mining, dredging, drilling and other slurries, muds, pastes up to 4 kg/l, based on ultrasonic sonochemistry.

Since 2011, Arenal is the first and only producer in the world of ceramic ultrasonic spectroscopy density and massflow analyzers. As the stability and accuracy in 2021 is higher than nuclear analyzers, they will replace all nuclear densitometers and also offers accurate monitoring under water and in subsea mining applications. The technology is based on measuring physical acoustical properties in combination of Acoustical Spectroscopy of the slurry, which are, in a chemometry model, directly related to the physical properties of the slurry, like density, solids concentration and temperature.

For liquid density applications between 0.7<SG<1.4, we offer a PEEK, PI, Quartz and PBI sensor.

Due to continuous improvement of the software to comply with customer requirements, the software changes rapidly and this manual is updated on a continuous basis. If your software needs an update or upgrade, please refer to the Maintenance & Support section 5 of this manual to support you in your decision and to lead you through the updating or upgrading procedure.

This manual is only valid for the software version on the front page.

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1. Preface

1.1 Our philosophy

Thank you for purchasing and using the slurry density and slurry massflow analyzer from Arenal PCS. Our goal is to produce the most accurate ultrasonic and thermal sensors and transmitters on the market for most demanding applications in all global markets. Secondly, we aim to give you the most comprehensive calculations available for controlling most industrial processes, based on the measuring values in combination with multi parameter calculations. As our PLC/HMI can be connected to any control valve or other equipment, local processes can be fully automated with Arenal's Slurry Density and Massflow Analyzer. For more sophisticated processing and HMI interaction, we advise to use the QA01 Process Chemometry Analyzer.
Finally, Arenal has a philosophy for ongoing continuous improvement to suit most demanding applications in the world. We hope that we can contribute eventually to all of your process systems on site.

Arenal aims to satisfy end users with regards to optimization and control of all their processes.

1.2 Purpose of this manual

This manual explains the installation, configuration, operation, calibration and maintenance of the Arenal QA03 Slurry Density Analyzer and Slurry Massflow Analyzer, including probes, transmitters, modules and cables.

1.3 Symbols and conventions

The following words and symbols indicate special messages:

	Caution! This sign indicates that failure to follow directions could result in damage to the equipment or loss of information.
	Warning! This sign indicates that failure to follow directions in the warning could result in bodily harm.
	Important! This word indicates that the text that follows contains clarifying information or specific instructions.

	Interesting! This word indicates that the text that follows contains comments or interesting points of information.

1.4 Abbreviations

All abbreviations in the manual are listed here.

QA03-SDA	Slurry Density Analyzer
QA03-SMA	Slurry Massflow Analyzer
QT016-UDT	Ultrasonic Density Transmitter. Electronic module to send high voltage pulses to the probe and receives and analyses returning echo's. The SDA and SMA however further analyses these raw values and calculates the SG, Density, TSS and temperature.
QP015-UDP	Ultrasonic Density Probe to determine Slurry Density
QC000-QQ	Connection cable between transmitters or modules to the SDA or SMA
QC014-UDC	Coaxial cable for harsh conditions in mining industry, to connect the UDP with the UDT
QT656-TMT	Thermal Massflow Transmitter
QP654-TMP	Thermal Massflow Probe
QM132-IOM	See Chapter 10: IO Module
QM138-IOM	Extended Embedded IO Module on PCB board, which offers galvanic isolated mA inputs and outputs and relay contacts. The mA signals have a sensitivity of 16 bits. The module is connected on the base motherboard.
SDA	See QA03-SDA
SMA	See QA03-SMA
UDT	See QT014-UDT
UDP	See QP015-UDP
UDC	See QC014-UDC
TMT	See QT656-TMT
TMP	See QP654-TMP
IOM	See QM132-IOM or QM138-IOM

1.5 Document updates

Name

KWR-7QA03-901-220112-EN	Complete upgrade due to new displays, new software
KWR-7QA03-901-191218-EN	Par.1.5 added to follow improvements in the document, according to our ISO9001:2015
KWR-7QA03-901-191203-EN	Calibration "Step 3"procedure modified in Par 7.3

2. Technical specifications

2.1 Environmental characteristics

Ingress Protection	With touch screen display front side: IP65 Without touch screen: IP67 / EN60529
Temperature	Operating: 0-50 degC Storage: -10ºC to +60ºC
RH	Relative humidity 10-90% (non condensing)

2.2 Operation characteristics

Interfaces	Ethernet LAN RJ-45 10Base-T/100Base-TX	
	USB2.0 type A	
	Modbus RTU over 2 wire RS485	
Power	90-263 Vac. 50-60Hz	Standard
	24Vdc	Standard
	Consumption: 15W	
Display	5,7" Colour LCD soft touch screen display 256 colours, 320x240 pixels, 6MB FEPROM	
Weight	2,5 kg	
Dimensions	Outside dimensions: 330x200 mm. Depth: 120 mm	
Housing	Aluminum die case with dry coating	
Mounting	Mounting holes available: just remove the aluminum panels, no need for opening the lid of the enclosure	

2.3 Dimensional drawing
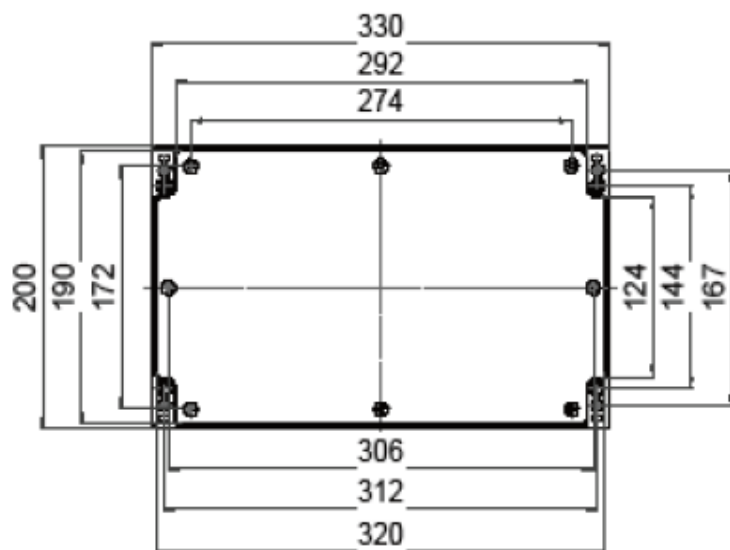
2.4 Panel cut-out

In case the HMI is not mounted in Arenal's standard enclosure, the HMI shall be mounted in another enclosure to protect it against dust and water. Due to the lack of components on the market, Arenal offers several HMI's. Each has different panel cut outs. Find below the panel cut-out specification of ProFace GP4301-TAD and GP4301-TADW:

Length: 156 mm (6.14 in)
Hight: 123.5 mm (4.86 in)
Panel thickness 1.6...5 mm (0.06...0.2 in)
Radius in each corner: 3 mm (0.12 in) maximum

When installing the GP unit in a slanted position, the GP unit face should not incline more than 30°.

30° or less
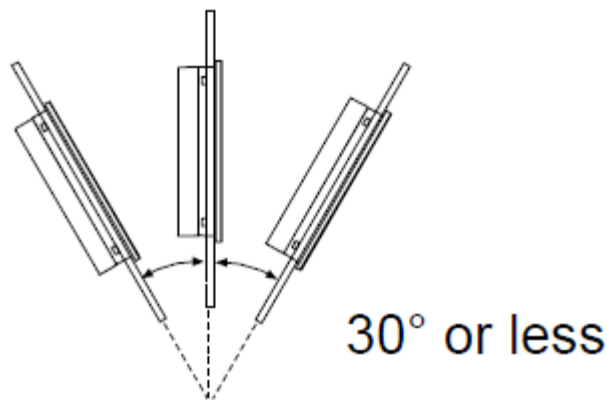
For easier maintenance, operation and improved ventilation, install the GP unit at least 100 mm (3.94 in.) away from adjacent structures and other equipment as shown in the following illustration.
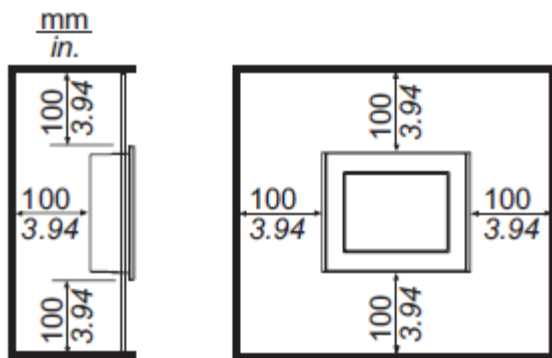
2.5 Spare parts

Item	Description
4-000-02	A spare fuse is always supplied on the main PCB board. Fuse medium delay 2,5A. Farnell 1354586, model 023402.5MXP, about 0,21 Euro
4-QA03-USB-16GB	Spare industrial USB stick for QA03, 16 GB. Do not replace this USB stick for a non-industrial USB stick, as they do not comply to the temperature ranges.
QP654-TMP	Spare/Replacement TMP sensor

3. Installation

3.1 Generic configuration information

A complete Slurry Density Analyzer system comprises of the following components:

1. QA03-SDA – Slurry Density Analyzer. The analyzer can be separated into different parts, depending on the requirements:
   a) Housing
   b) Power convertor
   c) Main PCB board
   d) HMI
2. QT0161-UDT – Ultrasonic Density Transmitter
3. QC013-UDC - Coaxial cable, in case of QP015-UDP probe, this items is included and not mentioned in the list
4. QC000-QQ-01000-XXX-XXX Connection cable from UDT to QA03
5. QP013-UDP - Ultrasonic Density Probes for submersible applications
6. QP015-UDP – Ultrasonic Density Probes for mounting in spool pieces are wafer cells
7. QB03-WFC – Wafer cell
8. QB05-SWC – Steel wafer cell
9. QB06-SPC – Spool Piece
10. QS – Services: like Remote Monitoring Services, local service assistance, System Integration Services, Spare Parts
11. When the massflow meter is supplied:
    a) QT656-TMT – Thermal Massflow Transmitter
    b) QP654-TMP – Thermal Massflow Probe
    c) QC000-QQ-00100-XXX-XXX Connection cable from TMT to UDT

As the QA03-SDA or SMA is the main part of every installation, where all settings are done and where all information is gathered. Additional information, needed to set up the Ultrasonic Density Transmitters, can be found in the enclosure of this manual.

3.2 Mounting

Arenal uses AluCase enclosure from Rolec Germany (www.rolec.de). To mount the enclosure to the wall, the lid does not need to open. Just remove the aluminum panels on each side: they are clamped and easily removable. Arenal supplies a mounting set in each delivery.

Fix the enclosure to the backpanel by standard available screws, like M5x25 socket head cap screws, DIN 912.

3.3 Electrical cables installation

The QA03-SDA is always supplied with three M20x1.5 threads for cable glands on the bottom side of the enclosure and 1x M16x1,5. It has the following cable entries (from left to right):

1. Power supply cable gland
2. mA input (ext flow, density or level meter) and mA output cable gland
3. Modbus RTU cable to remote UDT transmitter
4. External RMM (Remote Monitoring Module)

3.4 Internal wiring

The power AC/DC convertor is situated on the left side of the main board. In case of DC supply voltage, this module is replaced by a DC/DC convertor. The fuses are just on the top-right of it. The 24Vdc power output of the power convertor is connected through the main board to the power supply of the HMI and the IO Module. Also external transmitters are powered by this 24Vdc.

After opening the lid, the baseboard is visible.
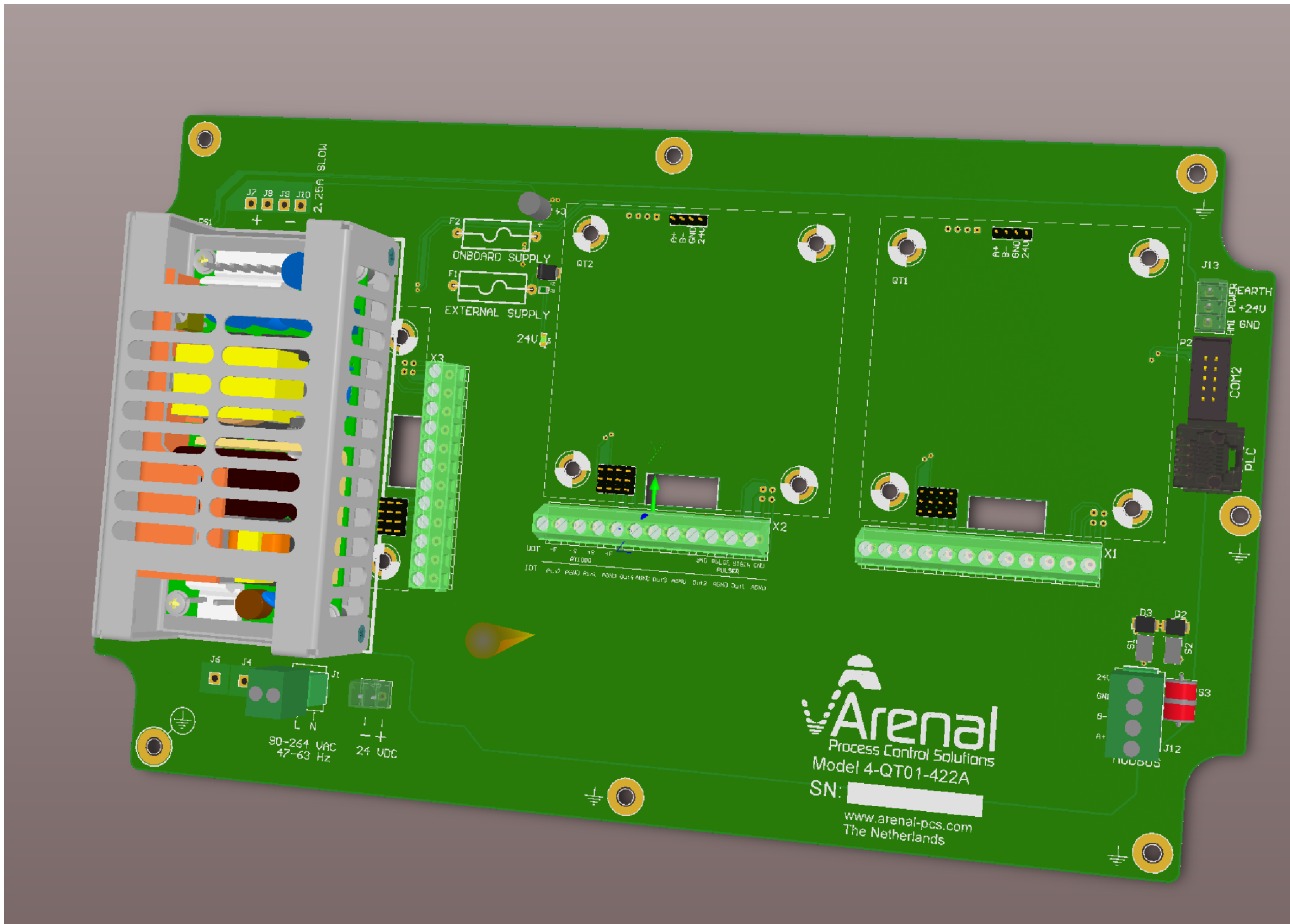
On the left side, the power convertor is placed.

The terminals in the middle (X2) are available for the IO module.

The UDT is connected to the Modbus connector, see drawings in enclosures.

Below the special mainboard for customers in South Africa, supplied by our partner KRT Instruments.
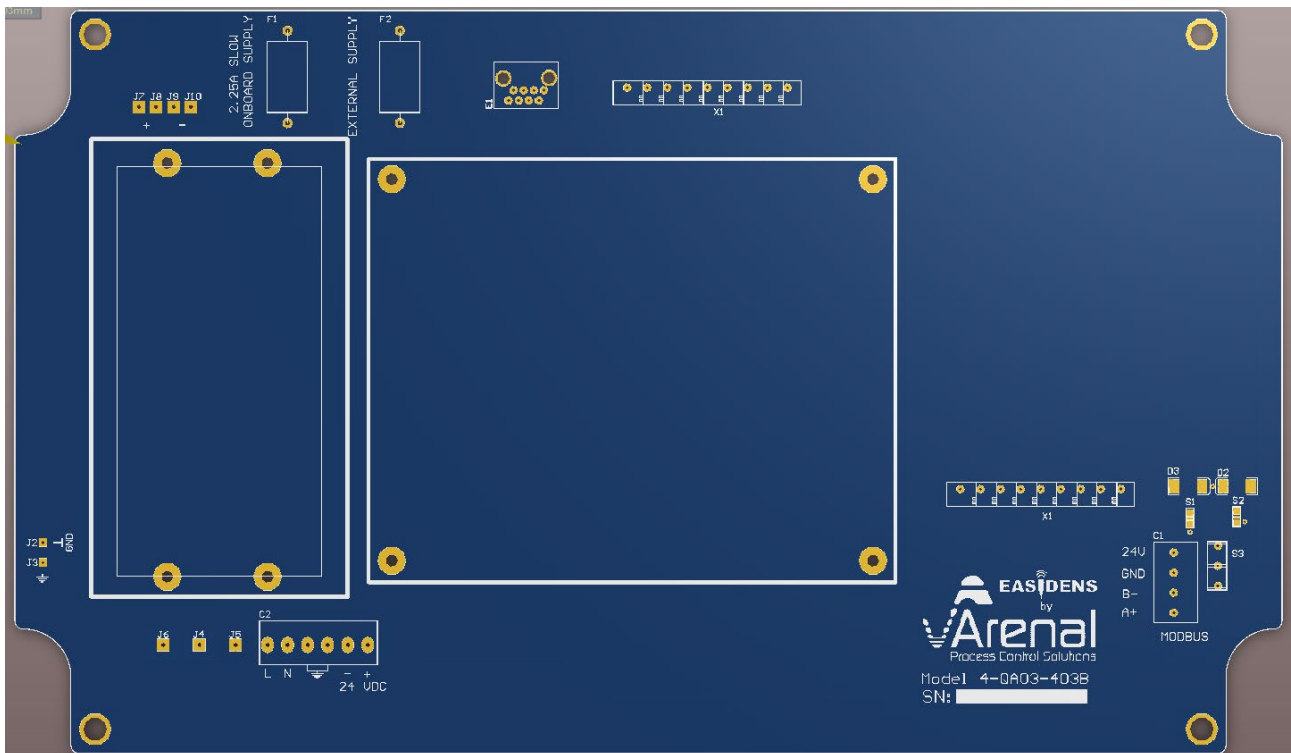
3.5 Connecting the QT0161-UDT

Check Chapter 8 and drawing QA03-SDA-DIS-VAC-XXX-XXX for the electrical connection on the main board. Connect these wires to the corresponding connections (A+, B-, 0Vdc, 24Vdc) on the UDT.

3.6 Connecting the QT656-TMT

Check Chapter 9 to learn how to connect the TMT to the corresponding connections (A+, B-, 0Vdc, 24Vdc) on the spare connector of the UDT.

Connect the thick cables to the H Force and H GND. Connect the thin cables to their corresponding Sense (H SenseP for H Force and H SenseN for H GND).

3.7 Connecting the QM132-IOM or QM138-IOM

For information on how to connect and configure the mA in and out signals as well as digital inputs and outputs, refer to chapter 10, as well as the installation manual.

4. Configuration

4.1 First time starting the system

Only power the SDA when all cables are connected and the probe is connected. Do not disconnect probes or transmitters when the system is powered up, as many transmitters are not hot-swappable.

Check again that the AC voltage is not connected to the 24Vdc connector

Once the unit is powered up, the lamp inside the SDA or SMA and UDT turns green and the lamp inside the HMI turns red.

If a display is connected, it automatically comes into measurement and control mode.

In case the mA output of the HMI-LT4301 is not connected, a mA signal error is displayed on the screen (Analog output error). Press (X) to remove the error (this error only occurs just after start-up or restarting and indicates that the mA out is not connected to the DCS system). If another error is displayed on the screen at the bottom, the system is not well configured: probably one of the transmitters is not connected. Refer to the Error Handling Procedure further in this manual to solve the problem.

The display now shows the measuring values. Wait for at least 15 minutes after start-up if you wish to perform calibration. For more information about calibration procedures, see chapter 4.

4.2 Menu structure

The menus can be reached by the Menu Bar on the top and the functions by the Function Bar on the bottom. All these functions are explained in the next paragraphs. In this paragraph, you get an overview of the most used required actions and the menu operation that is needed.

Some examples are given below. In the next subsections, the menus are explained in more detail.

Requirement	1st step	2nd step	3rd step	4th step
Change name of the Measuring Site Change date & Time & Language	Press: In Menu Bar	Press "System Settings"	Press "User Settings"	Change and save.
Change parameter settings and calibrate	SG 0.000 4.00 mA	See Chapter 4		
Check or change UDT settings or calibrate raw measurement values	Press: In menu Bar	Press "Ultrasonic Density Transmitter"	See Chapter 8	
Check or change IO settings	Press: In menu Bar	Press "IO Module"	See Chapter 10	

4.3 Menu screen and functions overview
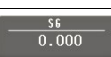
In this chapter, you find information about the generic hardware and software configuration, about how to set up the analyzer and the parameters.

MENU BAR → Parameter values → (example display) FUNCTION BAR →	

The picture above shows the main measurement screen. It consists of three parts: the MENU BAR on the top is for navigation through all setup and information menu's. The FUNCTION BAR on the bottom is for checking the status of important settings and offers special functions in specific menu's.
The middle the screen shows the four measurement parameters.

	Press this button to go to the home screen (see picture above)
	Press this button to go the graph screen, described in Par 3.4
	Press this button to go the configuration screen, described in Par 3.5
	Press this button to go the diagnose screen, described in Par 3.6
	Press this button to go the alarm screen, described in Par 3.7
	Press this button to go the information screen, described in Par 3.8
	When pressing this icon you return to the previous viewed screen
	Press this icon to get info how to set up the Ethernet network (IP address and Subnet Mask)
	This icon flashes once per second when the USB stick is connected to the system. If not connected, it does not flash. Press this button to go to the File Manager Menu
	This icon flashes once per second when logging is on. If logging is not on, it does not flash. Press this button to configure the logging interval time and to start and stop logging.
	Press this icon to change the intensity of the screen. 1 is high, 15 is low intense. Press again to store the setting.
	When this icon pops up, you have an active warning or alarm situation. Press this button for further diagnostics.

	Press this icon when taking a sample. Press the button on the next screen so the system registers in the logging file that a sample is taken for calibration.
	This button shows the current status of the security level, normally 0. Press this button to log in.
	Press this button to make a screen shot. The jpg file can be found on the USB Stick in the "Capture" directory.
	Save all settings to the files on the USB Stick. This icon pops up when user gets into the configuration pages.
	Go to the next page. In some cases, there is no following page: then it stays on this page or returns to the main page where you originally came from.
	To configure one of the four parameters, you can press the corresponding value button.

Furthermore, a warning can be shown on top of the start screen when the temperature is outside of the calibration range. The warning will show "Outside Temperature Range".
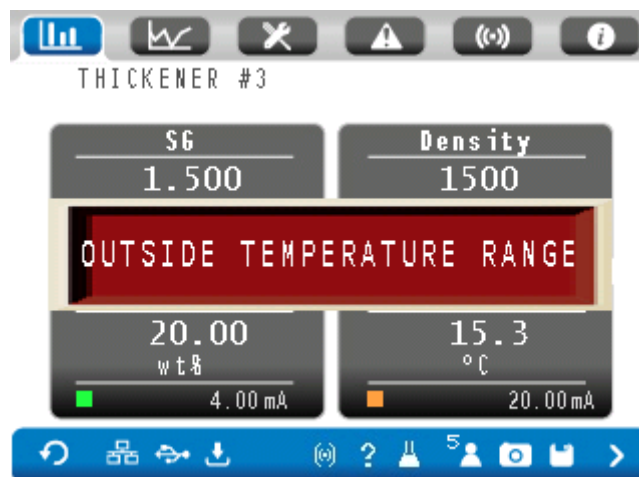
The minimum and maximum temperature for the calibration range can be found in the Calibration screen. In the following example, a warning will show when the temperature is below 5 degrees or above 30 degrees. The system will continue operating, but measurements are less reliable when operating outside of the calibration temperature range.
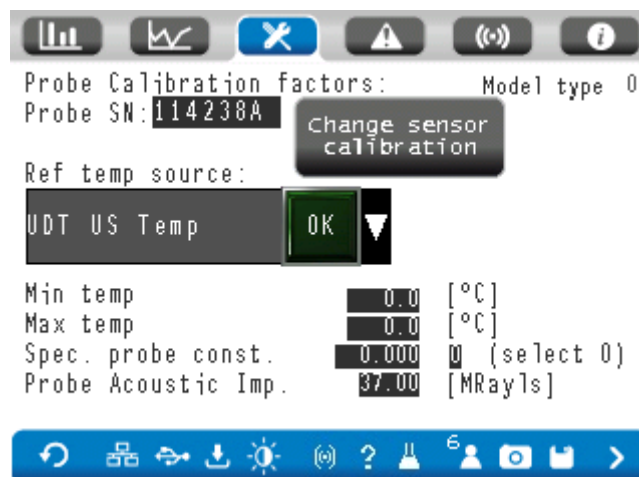
4.3.1 Other screens

Other screens are available to suit the model of your choice. The preferred screen can be selected in the user settings (see section 3.5.4.1).
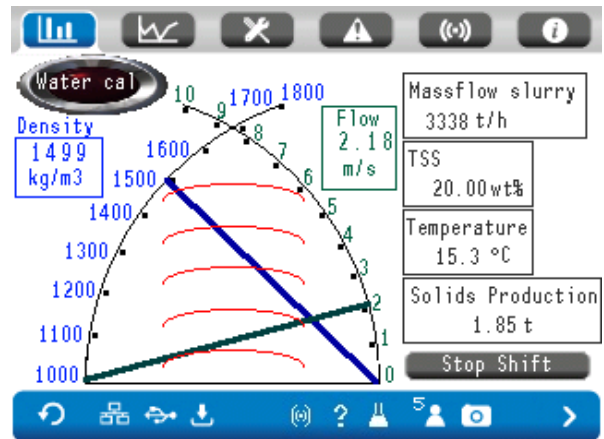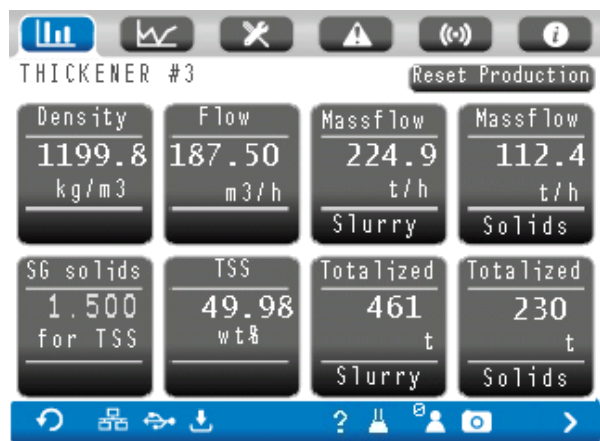
4.4 Graph Setup Procedure

Pressing the graph icon brings you to the time graph of the parameters. For each parameter, a graph is available. Currently selected graphs are 1 and 6, as these numbers are highlighted. Press the number of the corresponding graph to show it or not.
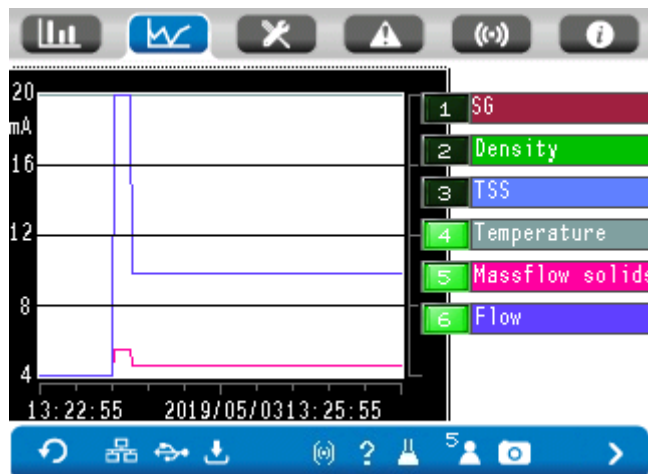
4.4.1 Timing settings (horizontal X-axis)

The time of the first measurement on the screen is written on the left bottom of the graph. The time of the latest measurement on the screen is written on the right bottom of the screen. When pressing ZOOM IN, the time of the first measurement on the screen is set to a later time, so less data points are shown.

When pressing ZOOM OUT, the time of the first measurement on the screen is set to an earlier time (if available), so more data points are shown. Each second, a data point is created.

4.4.2 MIN/MAX setting (vertical Y-axis)

The height of the graph is determined by the 4-20 mA value of that parameter, see the last page of the Parameter Setting. Log in to security level 3and press on the name box of the parameter (like "SG") then this specific page is popped up. A change of the 4-20 mA range will only change the graphs from this moment. Older values are not changed in the graph.

4.4.3 Select the graphs of your choice on the screen

The analyzer remembers which graphs need to be shown on the screen. Press [1]..[6] to select the parameter that needs to be shown (green light) or not (dark) on the screen.

4.5 Configure Menu

Pressing the configure icon brings you to the configure menu:
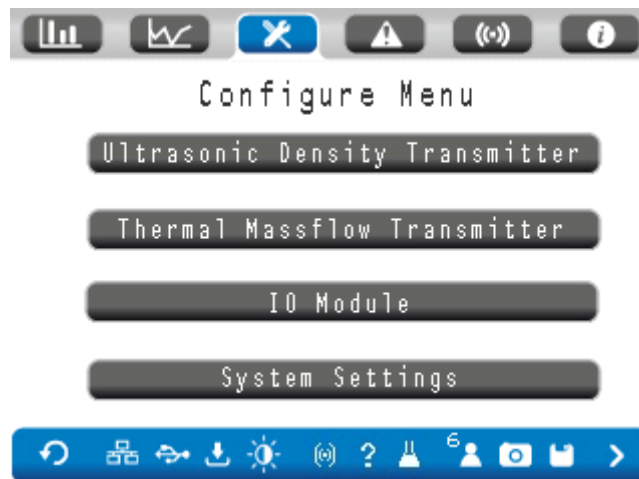
4.5.1 Ultrasonic Density Transmitter Setup Procedure

To check and setup the performance of connected ultrasonic density transmitters, press the corresponding bar. Further explanation of these modules can be found in Chapter 8.

4.5.2 Thermal Mass Flow meter Transmitter Setup Procedure

To check and setup the connected thermal massflow transmitter, press the corresponding bar. Further explanation of these modules can be found in Chapter 9.

4.5.3 IO Module Setup Procedure

To check and setup the connected IO module, for 4-20 mA in- and outputs and digital in- and outputs, press the corresponding bar. Further explanation of these modules can be found in Chapter 10.

4.5.4 System Settings Setup Procedure

In the System Settings Menu, a new menu bar appears, which corresponds to the current security level.
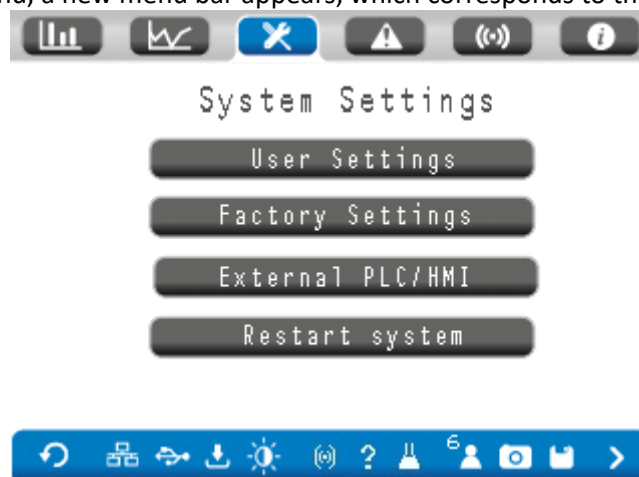
4.5.5.1 User Settings

After pressing the User Settings bar, the following screen appears:
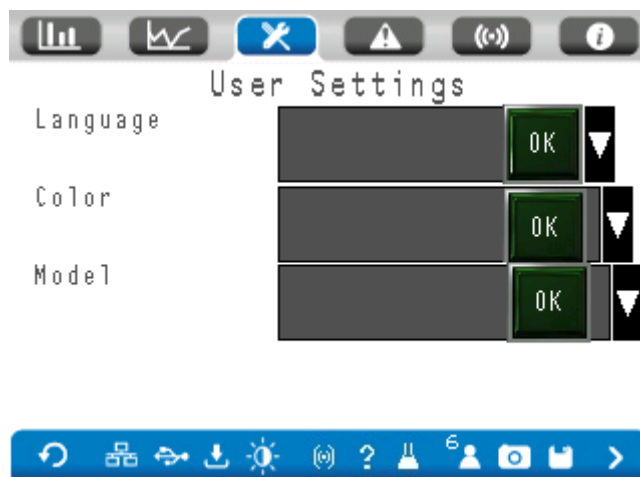
Change the language by pressing the grey button (and after that press "OK") to change to English, Dutch, French, German. SAVE the settings in the function bar when they are changed, otherwise, the language setting is not stored permanently.

Change the color of the menus if you like. Also SAVE and SAVE to USB.

Change the format of the initial measurement screen and calculation method. The options are: Standard (SG, density, TSS and temperature), Massflow (SG, flow, massflow solids, massflow slurry), Dredging (cross needle with density and flow, massflow slurry, TSS, temperature and solids production), Eight Parameters (density, flow, massflow slurry/solids, totalized slurry/solids production, TSS and SG solids). Another screen is available for the Attenuation application (see chapter 10.4.4), that shows TSS (g/l), temperature, massflow solids and massflow slurry.
After pressing the save button, the screen will change to the screen of choice.

Click on the next page to change the Date, Time and name of the Measuring Site. Furthermore, the brightness can be set. The standard setting is 0, which corresponds to the maximum brightness.
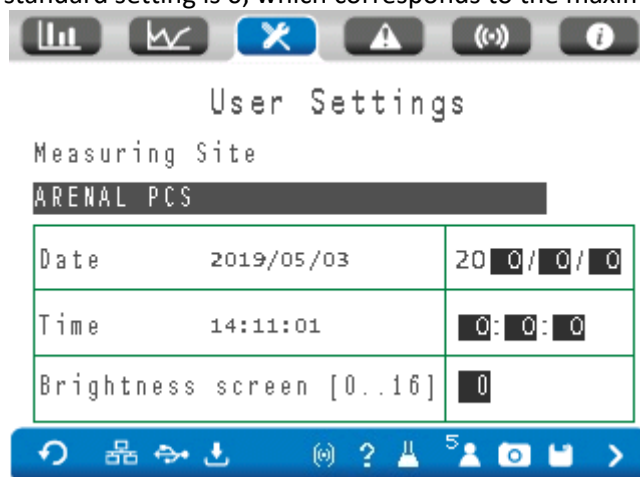
The current date and time are shown in the left column of the table. These are important for the datalogging. Change the date or time in the right column. No need to save, as the setting is done in the inner memory of the HMI directly.

The name of the measuring site is displayed on the measurement page. It is convenient in a network of analyzers and with remote monitoring that it is visible where the actual analyzer is installed.

Press the next page in case of a dredging application:
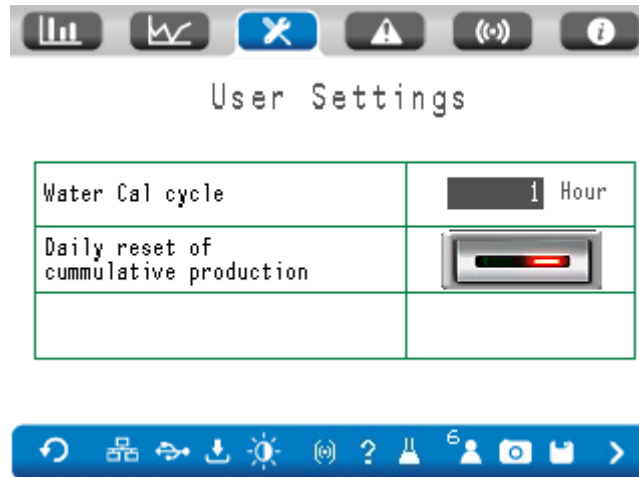
Set the duration between water calibration. And select if the cumulative production needs to be reset every day for the reports.

4.5.5.2 Factory Settings
This is a restricted area for users with login code 5.

4.5.5.3 External PLC/HMI

To change settings in case an external PLC is connected to the analyzer by Modbus TCP/IP.

4.5.5.4 Restart system

To restart the system and load settings from USB.

4.6 Diagnose Menu

The diagnose screen is specially made for service engineers to check the settings in the SDA/SMA. Additionally, in the Operational Log on the USB stick, all changes to the system are saved, so that it is easy to find out what happened in the past. Find this file in the directory "OPLOG". Each date has its own directory "OL120324" which contains the log files of March, 24, 2012. In this directory the CSV files saved.
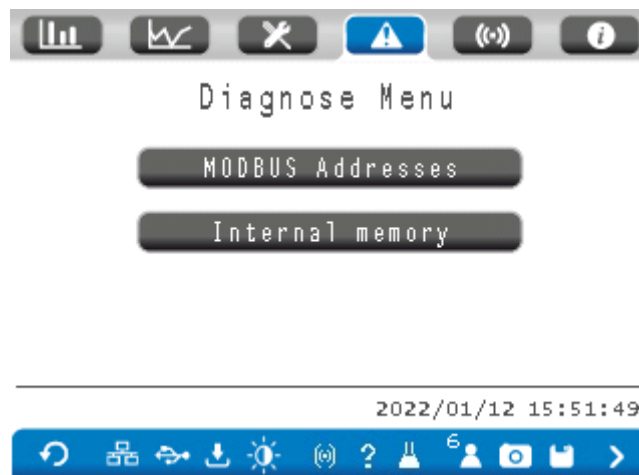
For a list of available Modbus TCP/IP addresses, see chapter 12. If specific values are needed, ask the Arenal R&D team.

4.7 Alarm Menu

Alarms in the SDA are generated when the values are outside of the range that is set.

More likely, alarms are generated in case of a problem in one of the transmitters or in the evaluation of measured data. The number of failures that can exist are numerous and therefor a clear explanation in this screen is helpful for the client to figure out what the cause of the problem is.

4.7.1 Active Alarm Handling Procedure

As part of the PLC functionality alarms can be generated if measured values are beyond their set boundaries, when an operation failure of the PLC exists or when data cannot be verified anymore.

Arenal offers two different methods to alarm the user:

1. By reading the measured values in the Modbus registers, alarms can be read out by Master PLC's.

2. By using the Arenal optional IO Module (see Chapter 10), QM138-IOM. In this module four relays contacts can be programmed to switch flash lights, horns or it may control other safety equipment, like pumps and valves. Note that this IO Module is also used to control pumps and valves in automatic sampling equipment. Is also contain of timer relay functionality. Currently in this SDA software, these relay contacts can only be programmed on parameter value alarms.

Active alarms are automatically de-activated when the alarm is not present anymore. Or when a new alarm is generated. In the historic alarm data, you can see the old alarms.
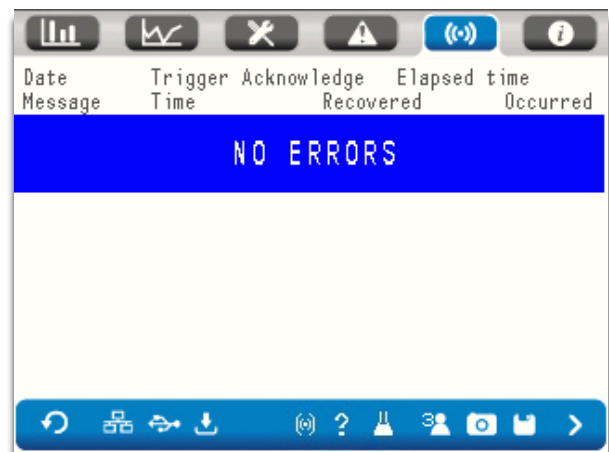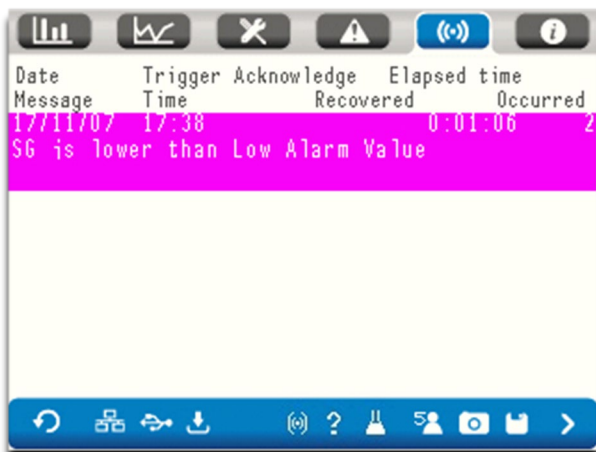
4.7.2 Screen warnings

The QA03 offers some warnings on the screen that will indicate that the unit is running, but will give wrong values. Example:
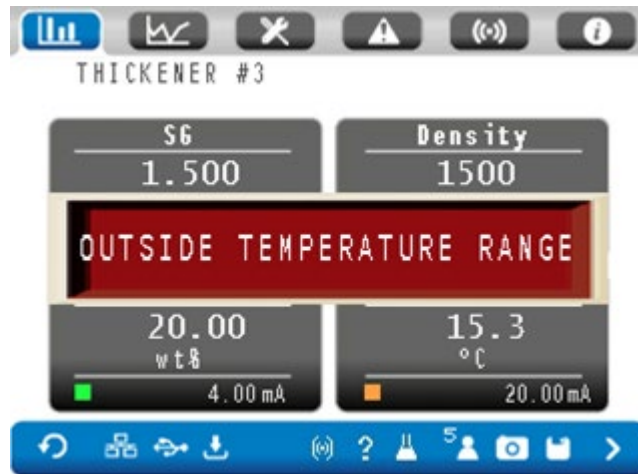
When the analyzer is out of its calibrated measurement range, the readings are most likely not accurate. The reading of Density, SG and TSS% can be inaccurate. To solve this, request a new calibration from Arenal after consultation. Cost are involved to create new calibration files. This file shall be added to the USB stick and shall be selected by the user. Alternatively, Arenal can handle this procedure when the RMM is installed.

Other similar errors are: too low voltage on the flow meter. Check the power supply.

4.8 Help Menu

This is the information and support screen. It gives you information about the model, the software version, the serial number and distributing company contact details.

After pressing the "Company info" bar, the following, or similar, page is shown:

After pressing the "Special company settings" bar (if available), specific customer pages are shown.

4.9 Function bar

The analyzer offers many functions directly available from the bottom bar menu.

4.9.1 Ethernet Network

The SDA can only be connected to Ethernet networks as a slave. This allows the user to get full control over the analyzer by remote monitoring.
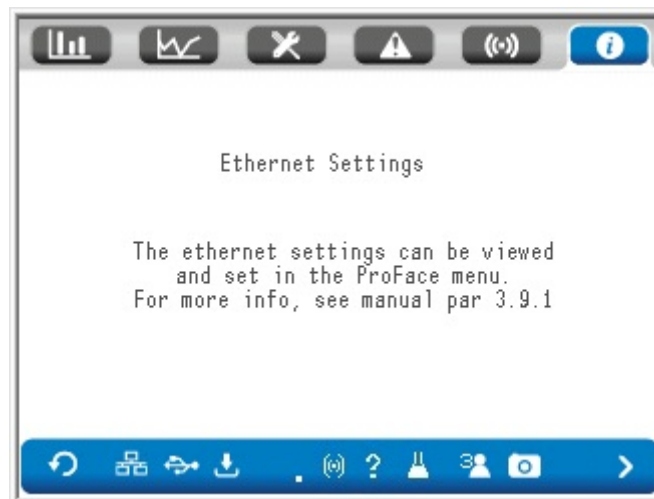
The communication protocol is from manufacturer Schneider Electric SA. It communicates according to IEC61131, syntax=off, low word first. The IP address is predefined by Arenal and are part of the 192.168.9.x network, sub-mask 255.255.255.000. But they can be changed in the Pro-Face menu, see chapter 5.

4.9.2 File Manager

The File Manager icon in the function bar flashes when a USB stick was inserted in the USB port of the HMI. Press this icon to go to the File Manager (Password required).
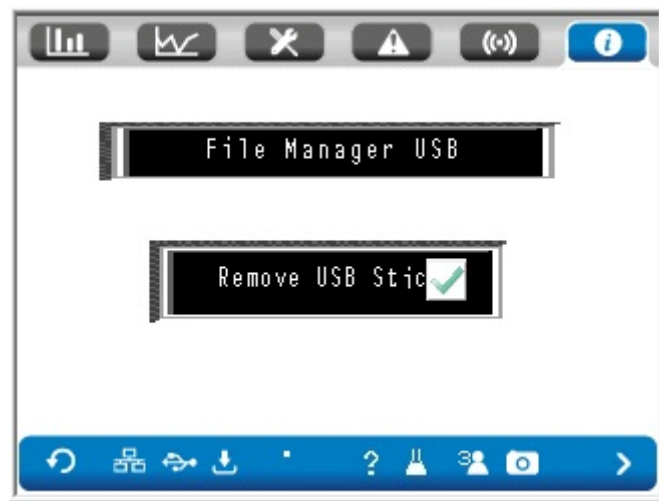
Two menu bars appear that are described in detail below:

4.9.2.1 File Manager Procedure

When "File Manager" button is pressed, then the File Manager starts. "CF" or "SD" is highlighted is yellow when the actions on the bottom have influence on the SD card, if present.
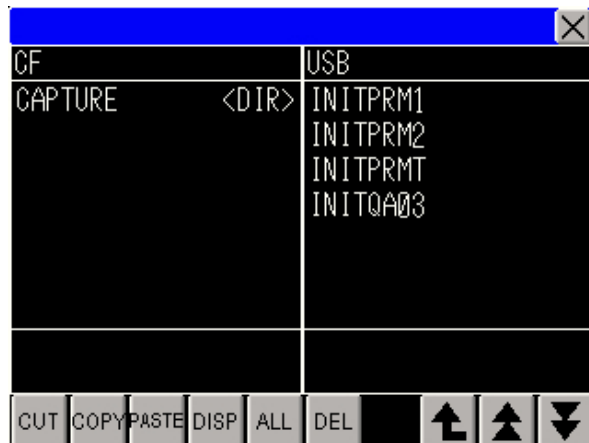
Press SD or USB to select the environment from which you want to copy or remove data.

Then this environment lights up. Select the files you want to use, by pressing the file. Use the dual arrow buttons to move upward and downward in the directory.

If you select a directory, press DISP to display the directory. To go back, press the single upwards arrow (return) button.

Select CUT to cut the file, COPY to copy the file.

Go to the other environment (gets highlighted) and select PASTE to paste the file in this environment.

Escape from the File Manager by pressing X in the right top corner.

4.9.2.2 Remove USB Stick Procedure

If a USB stick was inserted in the USB connector, the indicator in the menu bar shows a cross X to indicate that it is not safe to remove the USB Stick now. Press "Remove USB Stick" and the indicator will blink a "V"-sign to indicate that it is now save to remove the USB Stick. If it does not blink V after pressing, then the USB Stick is not ready yet to be removed. Try again later.

4.9.3 Data Logging

Data Logging or Data Sampling is a commonly used function to store the measured data from all the parameters and additionally raw measurement values and the sampling number.

When the logger icon does not flash, the logging is OFF. When flashing, logging is ON. On both cases you can press the button to go to the Logging Screen.
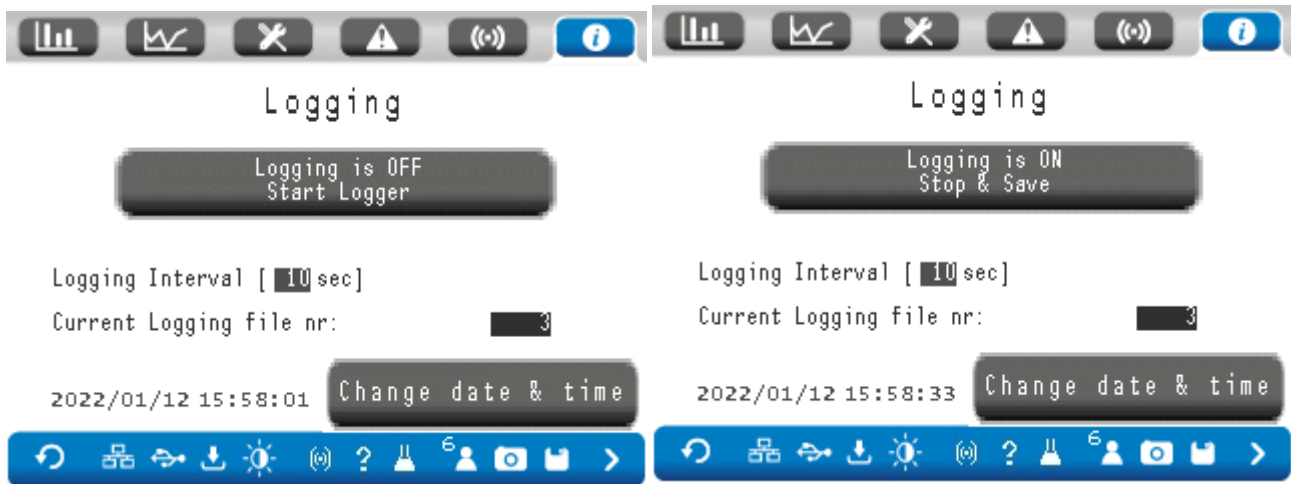
Before entering the Logging Screen, the level 1 password shall be entered. Then one of the following screens will appear:

In the first case, the logging is OFF and logging can be started by pressing the button.

In the second case, the logging is ON and logging can be stopped and saved by pressing the button.

You may change the Logging Interval. The internal memory is saved during power failure.

After 100 samples, a CSV file is automatically created on the USB stick. In the table below, it is shown which folders on the USB contain which data.

SAMP01	All end results and UDT data
SAMP02	TMT data
SAMP03	Calibration log

By pressing Next Page you find the current data storing process in the way you see it in the CSV file. By pressing up, down, left, right you can scroll through this data.

By pressing the next page, the logging data of the TMT and then Calibration log is shown.

4.9.4 Alarm

When the alarm flashes in the function menu, an alarm is active. Press this button to go to the alarm screen, see 3.7.1.

4.9.5 Take Sample

Press the Erlenmeyer icon if you want to take a sample from the slurry for analysis in the laboratory. The idea is that the values of the parameters are linked with the laboratory values by means of an ID number, date and time. This can only be done when the logger is ON. When the sampling is started, the frequency of the logger is set to 1 (highest frequency) so that as many data is logged as possible. After finishing the logger, the frequency is reset to its former setting.
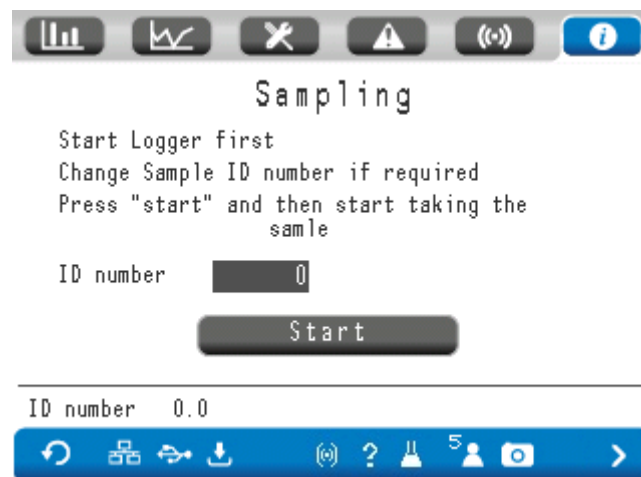
1) Check whether the logger is ON (logging icon must be flashing).

2) Insert the ID number (auto-increment)

3) Press START, when you are going to take a sample.

4) The next screen pops up:
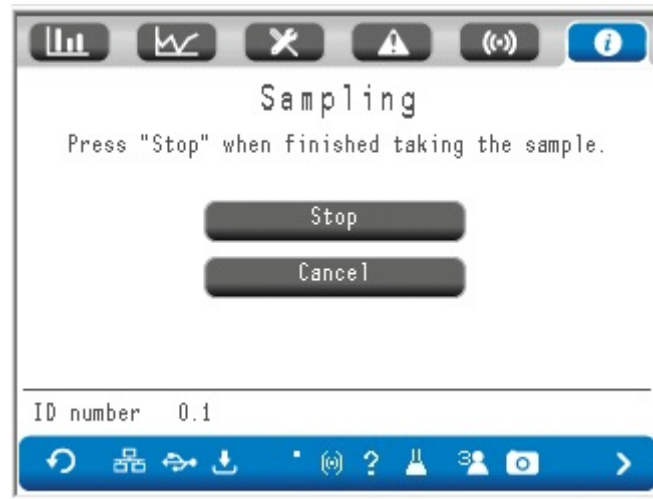
5) When you finished taking a sample (advise is that this takes at least 30 seconds), press STOP. If you want to cancel taking this sample, press CANCEL.

6) The following screen pops up:
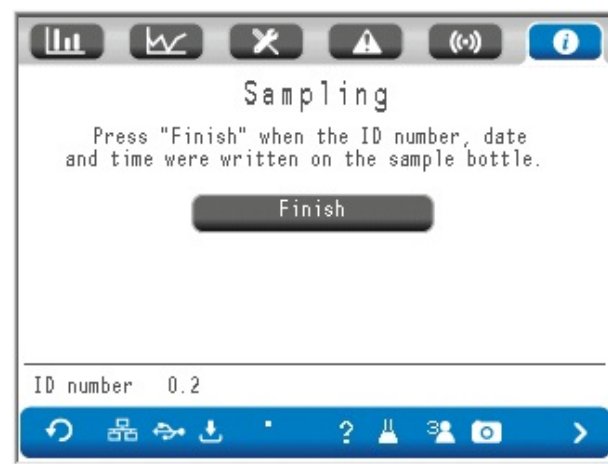
7) Press FINISH when you wrote down the ID number, date and time on the sample bottle. The ID, date and time can be found in the screen and this is the same date and time as in the logged data.

8) The following screen pops up:
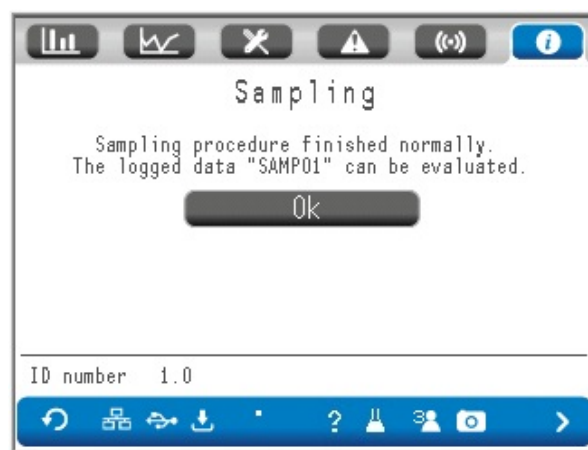
9) Like informed to you in this screen: the logged data can be evaluated, together with the laboratory values. To do this, go to the logger. Turn the logger off. Copy the content of the USB stick to your PC.

The sampling can be turned on by switching digital input i3. See chapter 8. QT01 – UDT (Ultrasonic Density Transmitter

4.9.6 Security Level

Most interactions between user and SDA are secured by a password. When the "Security Level" icon is pressed, or when a screen is entered for which a higher level security is needed, the SDA requests an ID and a password, required for the level that is needed.

After login, the level is shown in the icon.

The security level will be restored after 5 minutes or when the icon is pressed again.

Find your ID and password below. Loggin in will be tracked by the Operation Log.

Multiple users for same levels can be made as per your requirement.

	Level	Settings	ID	Password
Enduser	0			none
Enduser Service Engineer	1	User Settings	ES	16BC
Enduser Laboratory Engineer	2	Calibration Settings	EL	07AF
OEM Service Engineer	3	Advanced Settings	OS	****
Factory	5	Software Settings	FP	****
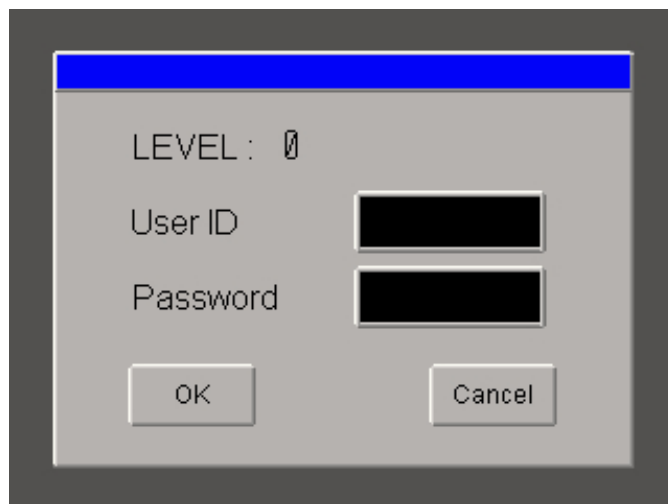
4.9.7 Screen Shot

Press this button to make a screen shot in JPEG format of the current screen. After pressing once, the file number will show up. Press again to take the screenshot. The file "CP00000x" is saved on the USB stick in the directory "CAPTURE".

4.9.8 Save and Store Data on USB

This icon pops up when user gets into the configuration pages. Pressing this icon will save all settings to the files on the USB stick.

4.10 Dredging – Water Calibration

In the dredging industry operators could require a frequent manual check of the health of the system by checking and calibration the water reference. This is because the background of the water could be changing due to salt concentrations. In the Configuration Menu / USER MENU the operator can select the amount of hours after a popup is shown to perform the reference water calibration.

4.11 Dredging – Reset Production

In the dredging industry operators could determine to calculate the total produced solids during a shift. At any desired moment, press "reset production" at the button with the cross meter. From that moment the totalizer starts again.
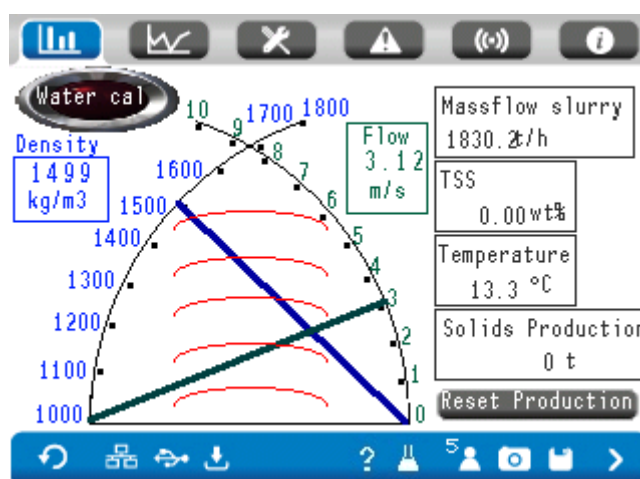
Press the logging sign and 2x > next page.

In the logging file SAMP02 the production data can be shown.

In case the production shall be reset every day automatically at 00:00h, this can be achieved by setting the Daily reset button. Go to Configuration Menu, press System Settings, press User Settings, press the Next Page button 2x.
The green light (value=1) is on when the production needs to be reset every day at 00:00. The red light (value=0) is on when the production is not reset.
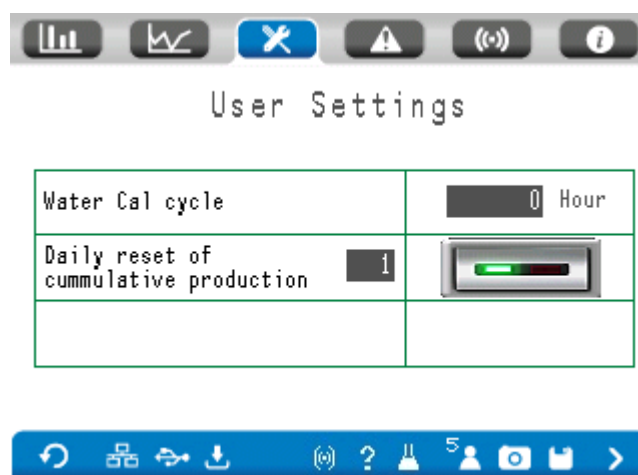
5. Offline modus

This chapter explains all functions and settings in the Pro-Face Offline Modus. The Offline Modus provides settings for internet connections and remote monitoring.

5.1 Enter the Offline Modus

As no physical buttons are available: a screen push method is avilable: press with one finger in the upper left corner and then immediately in the bottom right corner of the display, all within 0.5 seconds:
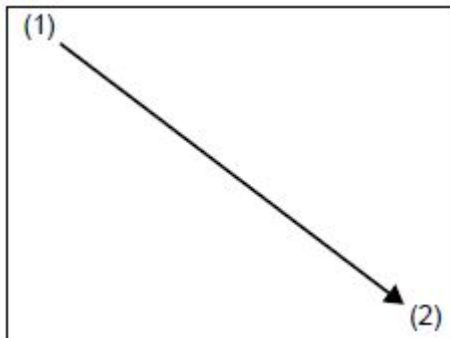
5.2 IP-address

In the offline menu, press Ethernet. Change the name, IP-address and sub-mask if needed. It is standard set to 192.168.9.xxx, submask 255.255.255.0

5.3 Standby mode

In the offline menu, press Screen Settings and tap the arrow at the bottom right. Then, use the Standby Mode dropdown menu to select None (screen is always on. Careful, the screen can become very hot and USB can break as a result) or Screen Off (screen turns off after the set amount of time).

5.4 EX-Viewer Licence Code

Is the Ex-Viewer licence code missing in the HMI and if you want remote access to the HMI, then enter the code in the Offline Menu.
Press Main Menu. Press Ethernet. Press Extended. Enter the GP-Viewer EX Key Code.

6. Start Up and Commissioning Guide

In all above chapters the density and flow meter was explained. In this chapter the steps for commissioning are explained. Pictures can be found in this manual. This chapter is intended to assist you in getting the system online in minutes. The quick-start guide is also provided as a separate document, version: KWR-7QA03-931B

1. Check and unpack shipment
2. Install the wafer, weldolet(s) or spoolpiece in the system
3. Install the analyser on the desired location
4. Mount the HMI
5. Connect the internal cables
6. Connect the Massflow transmitter
7. Power Up
8. Air and Water calibration for Density or SG
9. Slurry calibration
10. Configure digital and analog outputs

6.1 Check and unpack shipment

a. Check if box is complete and not damaged.
b. In case of more than 1 system make sure all components (Analyser, HMI screen with USB, Cable, transmitters UDT/TMT and Probes) are kept with correct system! The parts are labeled with: "order number"-"system number".

6.2 Install the wafer, weldolet(s) or spoolpiece in the system

Before installation measure internal diameter (ID) of existing pipe. ID of existing pipe must be equal to ID of wafercell or spoolpiece! If not contact Arenal!
-In case of horizontal pipe make sure probe is placed at 4-5 or 7-8 o'clock.
-In case of weldolet: Drill hole 36mm for WFC probe. Drill hole 28mm for SPC probe using insert for drill. See weldolet installation guide for more information.
-Insert and secure probe flush with pipe.
-In case probe does not come pre-connected to UDT. Connect inner core of the coax cable to

PULSE and the shielding of the Coax cable to SIG GND. Make sure to wear electronic static dis-charge (ESD) protection!

-Make sure all cable glands, lids and screws are tightened firmly.
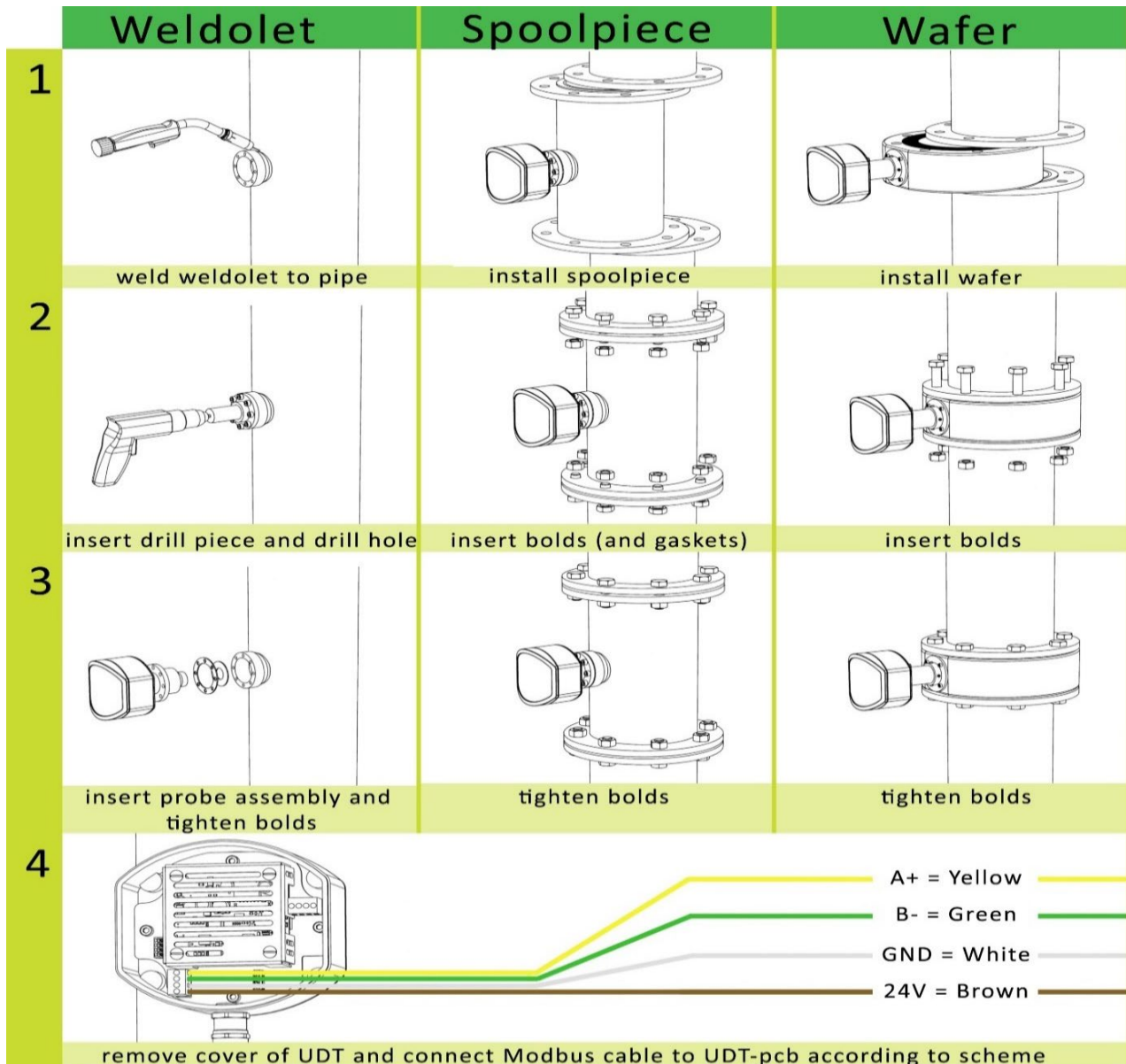
6.3 Install the analyser on the desired location

Maximum distance to the UDT and the TMT is 100 meter. This cable can be cut to length.

6.4 Mounting the ProFace HMI

The HMI is the ProFace screen with the computer. Tighten the screen with provided plastic black wrench.

6.5 Connect the internal cables

Connect the:

- COM cable to COM1 into HMI
- internal power cable to HMI

- Modbus cable to connector bottom right on analyser PCB
- 4-20mA signal out. Standard setting: E1 = SG+, E2= SG GND, E3 = TEMP+, E4= TEMP GND
- protective earth cable to bottom left connector on analyser PCB
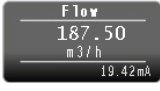
6.6 Connect the Massflow transmitter

If the systems comes with a massflow transmitter, connect it now.
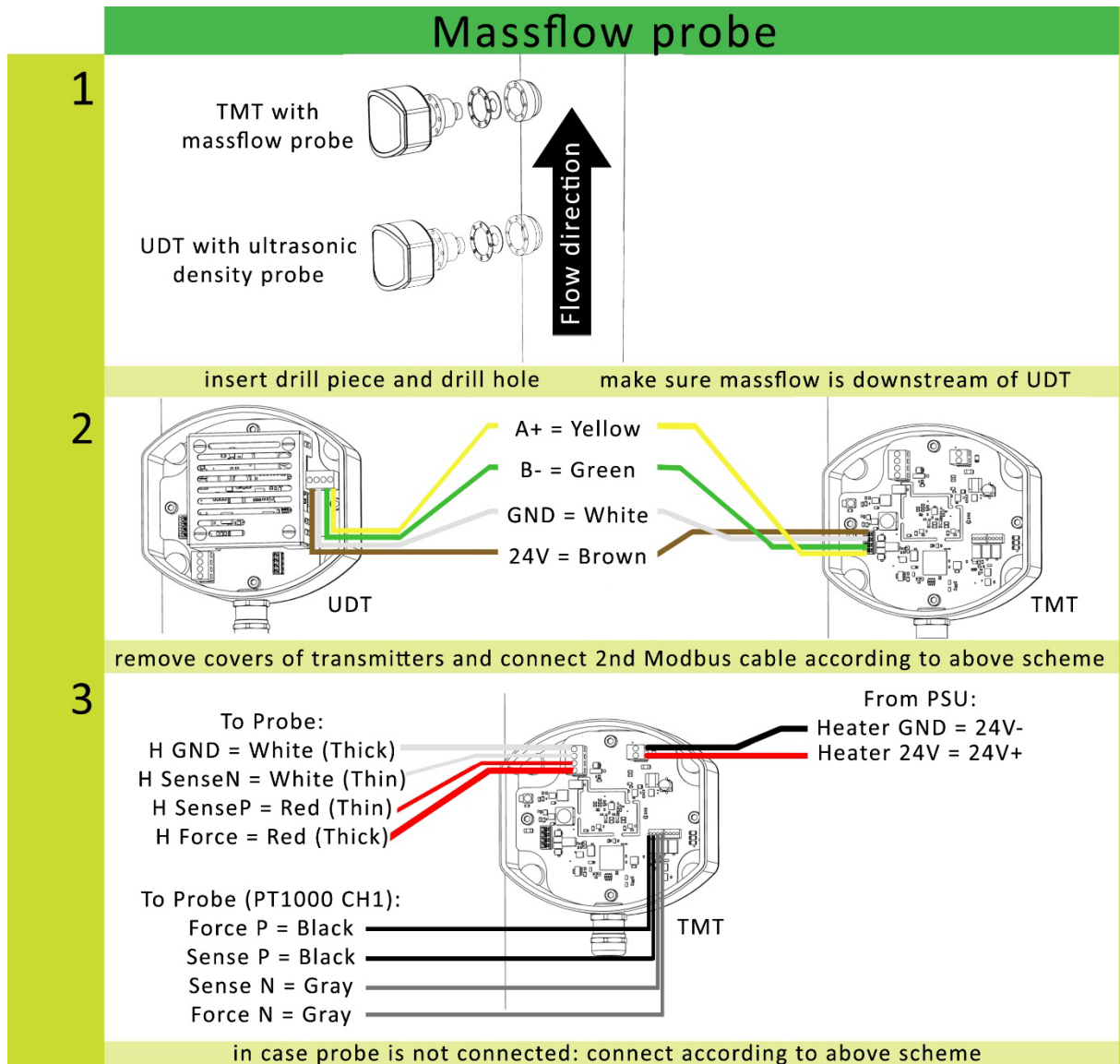
-In case of weldolet: Drill hole 36mm for Massflow probe.
-Insert and secure probe flush with pipe.
-Make sure massflow probe is placed after (downstream of) ultrasonic probe in flow direction for optimal result.
-Always unplug analyser (power of complete system) when working on UDT / TMT.
-The massflow transmitter (TMT) uses 24VDC from Modbus cable.
-The massflow probe requires its own additional 24VDC 150W power supply.
-Power for massflow probe cannot be drained from analyser PSU power.
-Use DC:DC converter for stable power supply when not using Arenal PSU's.

6.7 Power Up

- Do not power up just yet! For warranty purposes please send pictures of all made connections in analyzer and UDT to Arenal before fist power up and wait for approval!
- Turn on the analyzer (Only after approval of Arenal or Arenal appointed service provider)
- In case the mA output of the PLC is not connected, a mA signal error is displayed on the screen. Press (X) to remove the error (this error is only valid during start once).
- Press [X] -> system settings -> user settings and set your personal settings and time. Do not forget to press OK after each change and finally the save [save] button. (In case of password prompt use ID: "OS" with password: "27CD")
- The display shows the actual measuring values. Wait for at least 15 minutes after start-up if you wish to perform calibration.
- Press [X] -> system settings -> user settings. Set model to Massflow. Press save [save] button. (In case of password prompt use ID: "OS" with password: "27CD".)
- In main screen press [Flow 187.50 m3/h 19.42mA]. From the pulldown menu select: Thermal Massflow Transmitter-> OK. Set ID of the pipe and desired output unit. Click the save [save] button.
- Check if logging is on, 4.9.3 Data Logging

6.8 Air and water calibration

To perform an air & water calibration, follow the next steps.

a) Make sure there are no alarms on the display. If there are any alarms shown, please refer to the Alarm Section in this manual to resolve them first before the Slurry Calibration is attempted.

b) Press the SG box (or density box) as shown in the figure below.
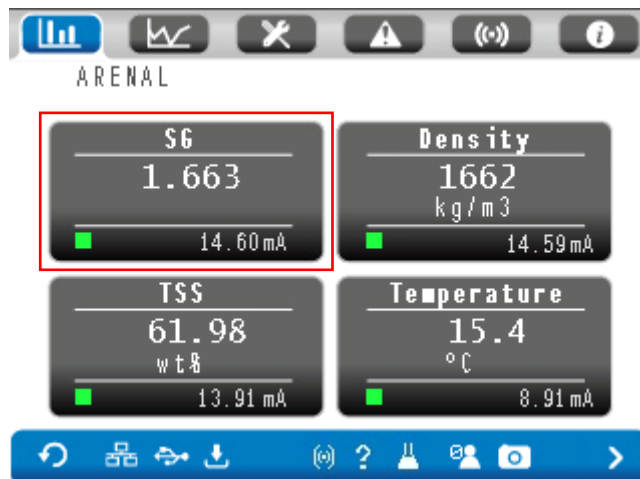
c) Press Water Calibration.
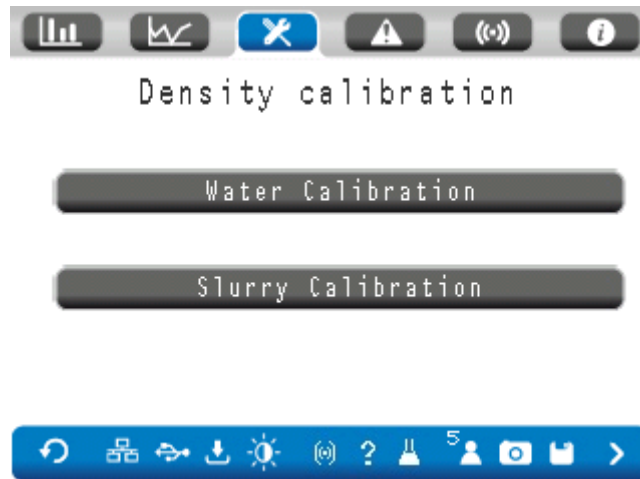
Density calibration

Water Calibration

Slurry Calibration

d) The following menu will open with a prompt for a level 2 User ID and Password code in order to gain access. See par 3.9.7 for the code list.

LEVEL : 2

User ID   EL

Password   ✳✳✳✳

OK   Cancel

Water Calibration
Make sure that water is in the pipe!
- Press Calibrate to overwrite the Current with
  the new value.
- Or enter a value in Current value and then Save
  and Restore.
                              New   Current value
Power Calibration factor   0.0000   0.0000

Reference temperature   0.00   Calibrate
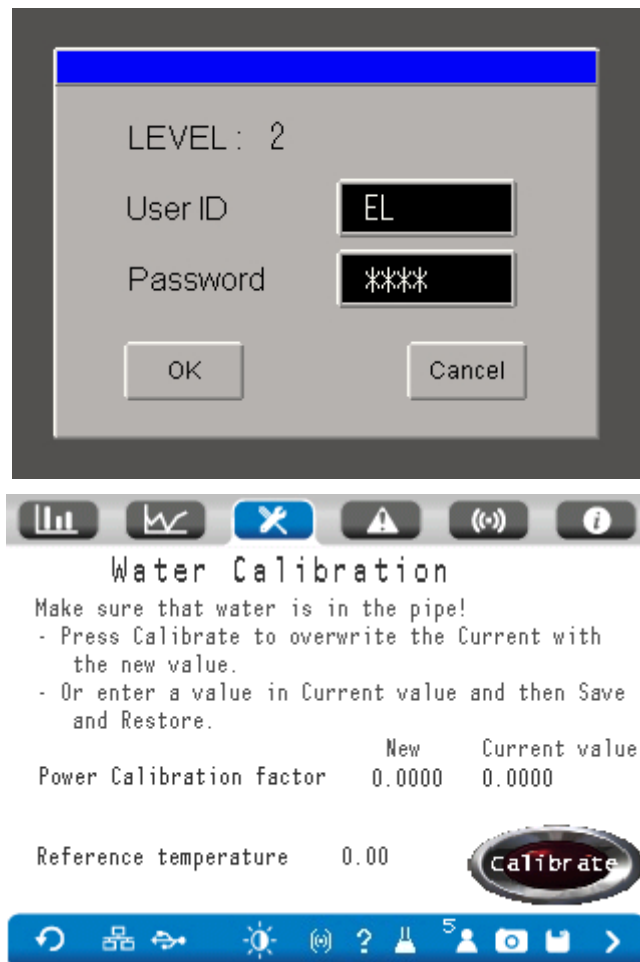
e) Make 100% sure that:

   1. The medium is water and pumped at a normal rate;

   2. The medium is as clean as possible. Take a sample to check it;

   3. The process SG and temperature readings are stable.

The, press Calibrate. Now perform the slurry calibration.

6.9 Slurry calibration

The conditions in our lab will be different from the conditions in the field. So an initial calibration is needed.

- Apply high dense slurry until a stable measurement of SG is given.
- Calibrate the density as well on this slurry, following the next steps.

a) obtain a representative grab sample of the slurry in the line and to weigh it accurately. This sample has to be exactly 1 liter and is best to be drawn from a sample point in a vertical part of the line where the sample is already homogeneously mixed. A 1L slurry grab sample beaker is preferred but if this is not available then a standard lab beaker of over 2L can be used. **Please note**: It is important to weigh the dry empty beaker before the sample is drawn since this weight has to be deducted from the total weight once the sample is drawn. Fill the glass beaker between 1 and 2 L. Make sure you do not need to drain, after filling the beaker.

b) The next step is to weigh the grab sample with an accurate electronic scale with at least a 2-digit kg readout. If needed, deduct the weight of the empty beaker. Divide the measured weight by the volume of the sample in the beaker.

c) Once the result is known, the actual Slurry Calibration can be done.

d) To calibrate one of the four parameters, press the corresponding grey box. However, always start with calibrating the SG / density.
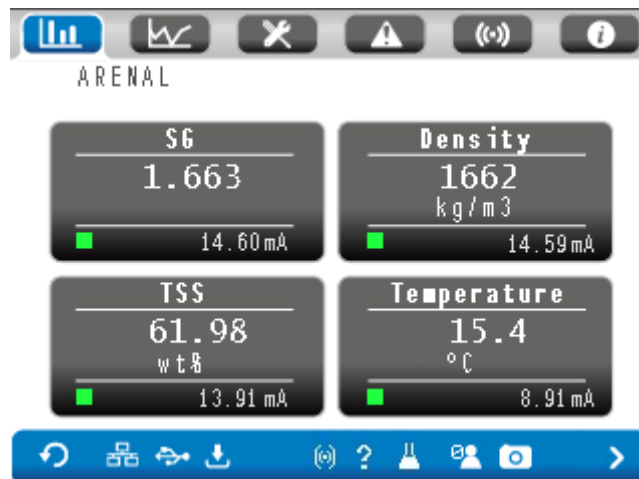
e) After pressing the SG box (or density box) in above picture, the following menu will open with a prompt for a level 2 User ID and Password code in order to gain access. See par 3.9.7 for the code list.
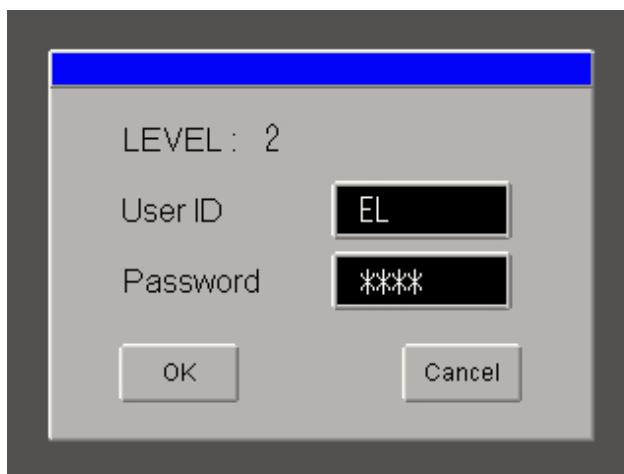
f) Press OK, which will then open the Calibration Menu. Select "Slurry Calibration".

g) Calibration is done with a linear function between a low value (process water) and a high value (f.e. high dense slurry). The initial setting could be:
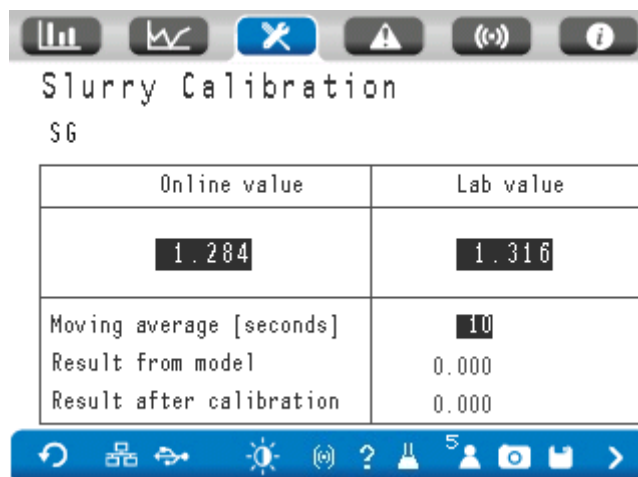
h) Note that you can choose to calibrate SG .

i) Read the value in the right column next to "Result from model" and insert it in the High block in the left "Online value" column. That is the SG / density reading of the Arenal analyzer at that moment, based on the physical model.

j) Next, insert the SG / density value of the grab sample in the right-hand High block in the "Lab value" column.

k) The last action to complete the calibration procedure **(Very important)** is to save all the new settings by pressing on the "Stiffy Icon" at the bottom of the screen.

l) The system is now calibrated with a new factor to the exact same value as the grab sample and is back online.

The other parameters can be calibrated in a similar manner by pressing the corresponding box. The Slurry Calibration of TSS is slightly different. The percentage is set from 0 to 100%. The TSS can only be calculated when the density of the solids is entered and saved.

• From time to time or after some part was replaced a Slurry Calibration may be necessary to compare the measurement with the lab results. It is at this stage assumed that all other set-up parameters such as measuring ranges, polynomials and output settings etc. are still the same as when the

system was originally commissioned. In case these parameters have changed or need adjustment for whatever reason, please get in touch with Arenal's support team. The Slurry Calibration corrects the density reading and can be done online within a few minutes. There is no need to switch the system off or to remove any parts from the line.

- The best way to do multi-point slurry calibration is to follow the next steps.

    a. Set Moving average to 1.

    b. Start the logger on a frequency of 1 Hz. The logger contains raw measurement data and results from its original model, as well as the calibrated values. With the logging file Arenal can assist you with increasing the accuracy of your calibration. During logging, the USB icon and the logging icon flashed every second.

    c. Pump process water through the line at the same temperature as the slurry temperature. Keep it running for at least 20 minutes. The laboratory value of process water ("Lab Value/Low") shall be 1.000. Enter the "Result from Model" in the box "Online Value/Low".

    d. Pump high dense slurry through the line. After 15 minutes, press the Erlenmeyer ⚗ button on the bottom.

        d.1. Press "Start" just before taking the sample from the process.

        d.2. Press "Stop" just after taking a sample from the process.

        d.3. Write down ID number

        d.4. This ID number is written down in the logging file.

    e. Repeat [3] several times for different slurry densities. Present the data in a xy graph in Excel to determine the best fit for the new calibration. Take a high point on this fit and add this point to the "high" calibration. SAVE.

    f. If you have any questions, ask Arenal for assistance.

Each second a new value is presented. If this interval frequency is not needed, one may choose to increase the moving average.

The Result from Model shows the value before this calibration.

Correlation graph

$y = 0,9769x$
$R^2 = 0,9991$
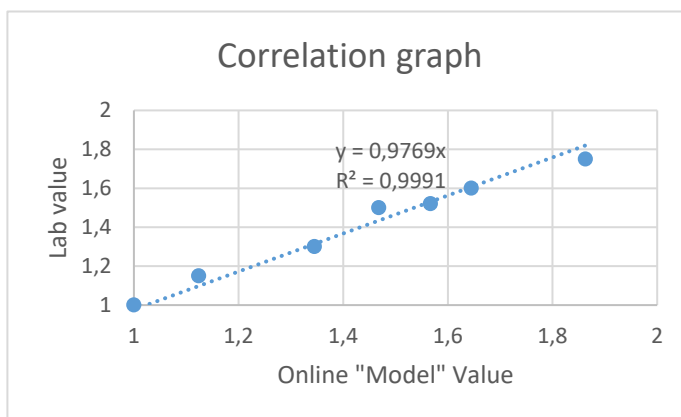
Example Multi-point calibration

Sample ID	Date	Time	Online value "Model"	Lab Value
			1	1
1	18-apr	9:00	1,567	1,520

2	18-apr	11:30	1,468	1,500
3	18-apr	14:00	1,124	1,150
4	19-apr	9:30	1,645	1,600
5	19-apr	11:00	1,345	1,300
6	19-apr	13:30	1,863	1,750

fictive high point calibration:
Online   2,0000
Lab   1,9538   (=0,9769 * online value)

In case of the slurry properties are temperature sensitive, perform a Temperature Sensitive Slurry Correction.
When a temperature drift appears to be present, after all previous calibrations, proceed as follows:

a) Press the "SG" box, login and press "View Air & Water Calibration". Make a screenshot (). This page:

b) Remove USB stick by Pressing () and "Remove USB Stick"

c) Send a complete copy of the data on the USB stick to the Arenal service team (service@arenal-pcs.com) by www.WeTranfer.com and add the data from the laboratory measurements (indicating date, time and SG) as well.

d) Arenal service team will send you a temperature correction coefficients, see below in the table. Press the "SG" box again, login and press "View Air & Water Calibration".

e) Enter the given value for "Temperature Correction Coefficient".

f) Press the stiffy icon to SAVE.

g) It is expected that a new slurry Slurry Calibration needs to be done. We made an initial suggestion in the table below.

h) In below table we state if you need to redo your air & Water calibration

6.10 Configure digital and analog outputs

Standard settings for 4-20mA output:

- SG: 1,0 … 2,0. To change in main screen press   -> slurry calibration -> click . Here settings may be changed.

- Temperature: 0°C … 50°C. To set own values in main screen press -> click . Here settings may be changed.

Correct mA output can be set by pressing   -> IO module -> mA out settings.

In case of IO module in analyzer output can be set to desired parameter number. (through the pages).

In case of use PLC for output. Set parameter 6 to Flow. (This replaces temperature output since only two mA outputs are available without IO module.)

Standard settings for 4-20mA Flow output are 4mA = 0 m/s and 20mA = 10m/s.
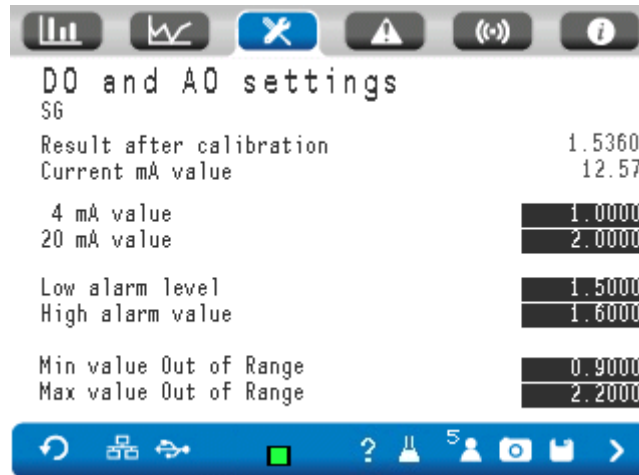
On this page, you can change the mA output range, the alarm levels and the model boundaries. Press the save icon to use and store the new values.

In case of a low or high alarm, the cause of the alarm is visible by a lamp on the screen:
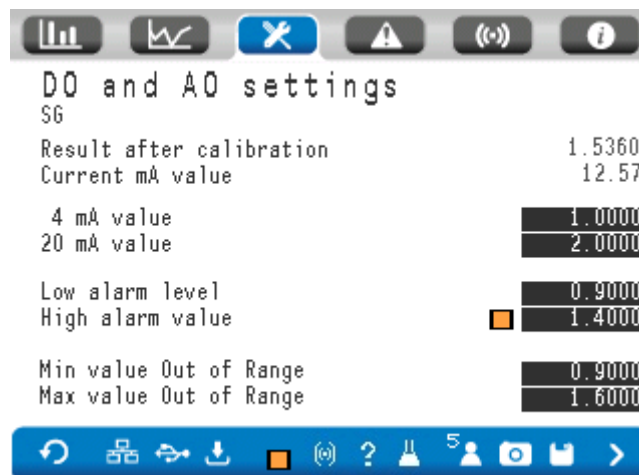
7. Calculations

In this chapter an explanation can be found on the background of our measurements.

7.1 Temperature

The temperature (T) of the slurry can be measured by an ultrasonic sensor, only when the ultrasonic signals in the sensor are influenced by a temperature change. It appears that the speed of sound in the probe is depending on the probe's temperature. During lab tests the relation between temperature and speed of sound is determined and the coefficients of a polynomial equation are entered into the ultrasonic transmitter. As speed of sound is accurately determined, the sensitivity of ultrasonic probes are better than PT1000 elements.

7.2 Density and SG calculation

According to physical laws, the acoustic impedance (Z) is equal to the speed of sound (c) in the liquid and the density (ρ) of the liquid, as a specific temperature (T). So ρ = Z/c. c is a function (polynomial equation) of Z and T, so ρ = f(Z, T), or a little different and better: SG = f(Z,T). This is a polynomial equation given in the ultrasonic transmitter.

Density is calculated by multiplying the SG with the density of water (polynomial equation with the temperature as an input) at the same temperature.

7.3 TSS calculation

The amount, or weight percent suspended solids, are calculated by the next formula (ref: Wikipedia)

$$\phi_{sl} = \frac{\rho_s(\rho_{sl} - \rho_l)}{\rho_{sl}(\rho_s - \rho_l)}$$

Where,

ϕ_{sl} is the solids fraction of the slurry (state by mass)

ρ_s is the solids density, entered in the ultrasonic transmitter

ρ_{sl} is the slurry density, calculated before

ρ_l is the liquid density, which is as a standard water

In aqueous slurries, as is common in mineral processing, the specific gravity of the species is typically used, and since is taken to be 1, this relation is typically written:

$$\phi_{sl} = \frac{\rho_s(\rho_{sl} - 1)}{\rho_{sl}(\rho_s - 1)}$$

Even though specific gravity with units tonnes/m^3 (t/m^3) is used instead of the SI density unit, kg/m^3.

Above function is implemented and can be locally calibrated if needed. As a basis for the calculation, the model result of SG is used, not the field calibrated value.

7.4 Flow calculation

Assume ID of pipe DN100 = 98 mm = 0,098 m. >> Surface of the cross section = pi/4*D^2 = 3.14/4*(0,098^2) = 0,00754 m2

If velocity is 5 m/s, the flow is: 5*0,00754 = 0,0377 m3/s = 136 m3/h

7.5 Massflow calculation

Assume:

SG of solids= 4200 kg/m3

Slurry density=1250 kg/m3

Flow= 136 m3/h

Slurry Massflow= density*flow = 1250 * 136 = 45000 [kg/m3 * m3/h] = 45 t/h slurry massflow

$$\phi_{sl} = \frac{\rho_s \left(\rho_{sl} - \rho_l \right)}{\rho_{sl} \left(\rho_s - \rho_l \right)}$$

TSS= 4200*(1250-1000)/(1250*(4200-1000)) = 4200*250/1250*3200 = 26,25%

Solids massflow = 26,25% * 45 = 11,8 t/h

Production time = 24h -> Solids Massflow production = solids massflow * 24 = 284 t/day

8. QT01 – UDT (Ultrasonic Density Transmitter)

This chapter explains all connections, functions and settings for the QT01x-UDT. This module controls the Ultrasonic Density Probe.

8.1 General information

The Ultrasonic Density Transmitter (UDT) produces an electronic high voltage pulse for the Ultrasonic Density Probe (UDP) and samples, digitizes, conditions and averages the analog measurement information. The information is stored in the Modbus registers to make it available to the SDA.

The SDA saves its measured values to its internal user memory. In addition, according to the user Parameter setup, calculations are done on raw, digitized and filtered measurement values.

To control the UDT, the SDA runs a small program to receive the digitized, raw measured values, evaluate them, change settings in the UDT or starts an error.

The UDT is not hot swappable, so remove power from the SDA before connecting it to the UDT. Also first connect the Ultrasonic Density Probe (UDP) to the UDT before powering up. Once powered up, it runs automatically.

For Slurry density monitoring we offer 9 product variations:

QT011..QT017 and QT019: UDT is mounted in a separate enclosure

QT01x…QT019 UDT: UDT can be preinstalled on the base board or mounted remotely

When changing the UDC, always note that the inner core of the coaxial cable shall be connected to "+" on the bottom terminal of the UDT. The shielding shall be connected to "-". Mounting reverse wise will depolarize the UDP.

Do not (never!) short circuit the "+" and "-". The 180 Volt pulse will cause too high currents, that the pulser circuitry will get defect within 1 ms.

Do not switch the connectors of the power supplies.

Do not power the 24Vdc circuitry with 90-263 Vac power. Also not when the fuse is not in place. The fuse only is a security for the 24V+, not the 0V. This will affect all electronics on board.

8.2 Electrical connections

Connect the inner core of the coax cable to SIG-IN or PULSE. Connect the shielding of the coax cable to SIG GND. Different versions of UDT's are available, but the names are the same.
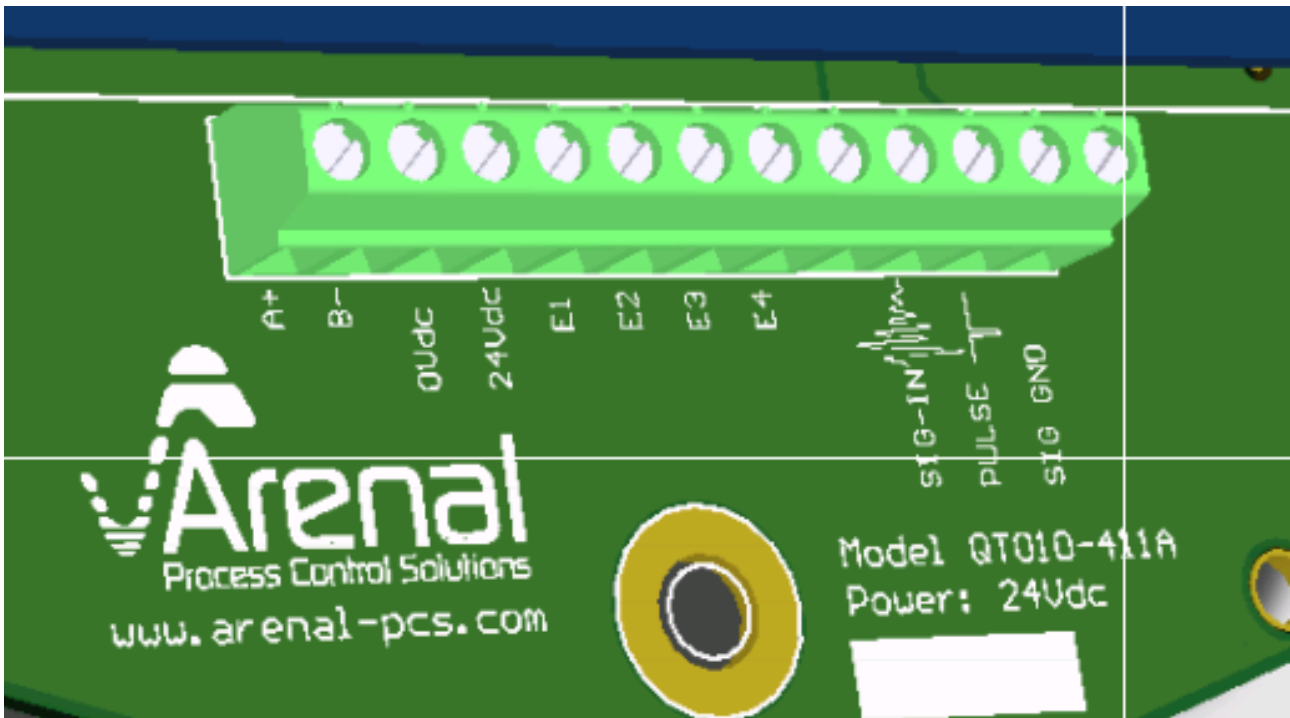
The connections on the baseboard 4-QT01-422A are available on the 12 pin terminals:

F-   White/Brown: Forced current of the PT1000

S-   White/White: Sense of the PT1000

S+   Red/Green: Sense of the PT1000

F+   Red/Yellow: Forced current of the PT1000

GND   Not used

Pulse   Not used

Sig in   Signal in, pulser signal and echo's (inner core of the coax)

GND   Ground of the Ultrasonic Density Probe (shield of coax)

8.3 Advanced Setup

To set up the UDT in the analyzer, go to Configuration Menu and press "Ultrasonic Density Transmitter".
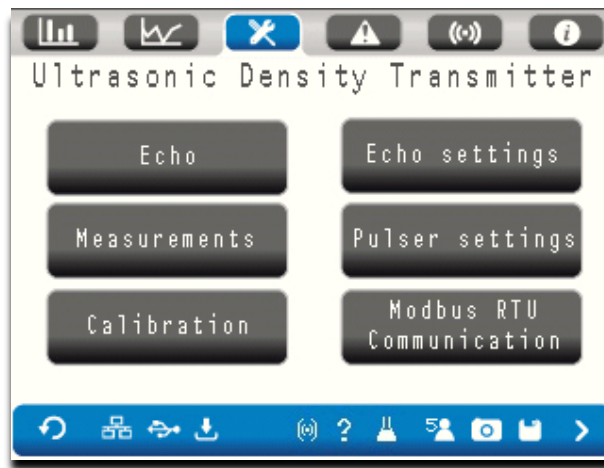
8.4.1 Echo

Press "Echo" in the menu bar to show the actual echo from the probe. This echo is updated each second.
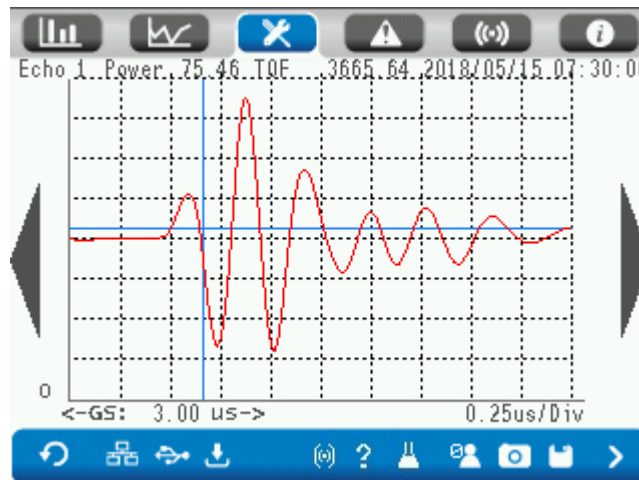
Important is the shape of the echo. This one looks great; it should always look like this. Only in case of air bubbles, the shape of the echo changes.

The scope shows the amplitude of the echo within the ADC range of the circuitry. The x-as shows the time of flight after the initial pulse in microseconds.

8.4.2 Measurements

Press the bar "Measurements" to find the end results of the UDT: in the left column the results are shown, in the right column the raw values are shown. If a PT1000 is not connected, the result of the calculation is -588.
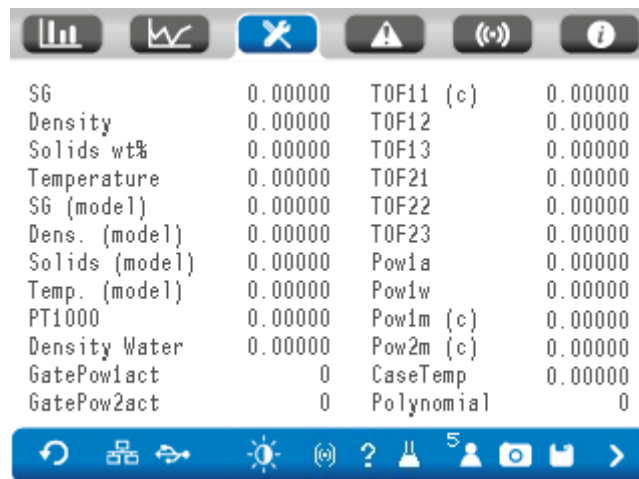
8.4.3 Menu Bar: Calibration

Press the bar "Calibration" to find the calibration coefficients of the probe.
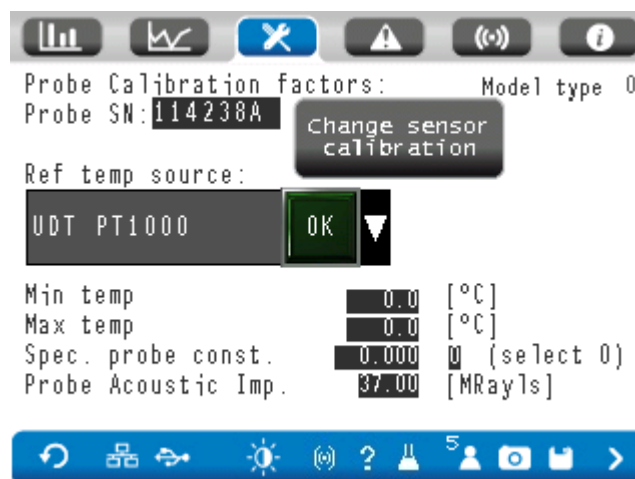
The coefficients are read by the calibration file on the USB, starting with the Serial Number of the probe, followed by a version number given by Arenal and shall be exactly filled in. This name is shown in "Probe SN". If you change it to another probe, then change the Probe SN and press "Change sensor calibration".

No coefficients should be changed, unless requested by Arenal.

8.4.4 Modbus RTU Settings

To check the communication and the serial numbers of the UDT and the UDP, choose Modbus RTU Communication in the menu. The password will separately given by the Arenal Service team.
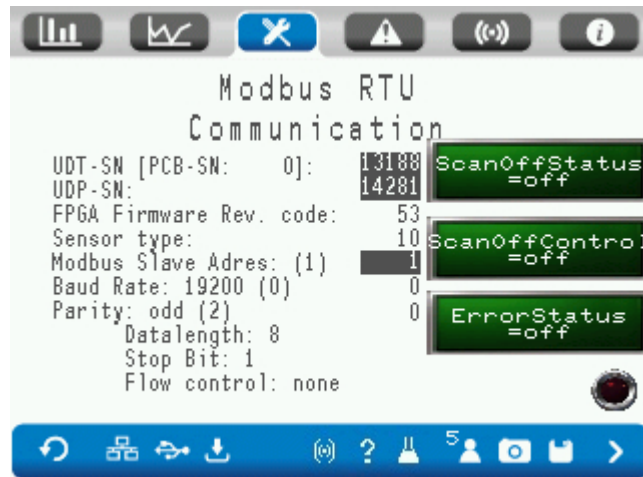
Do not change these settings unless requested by Arenal.

8.4.5 Echo settings
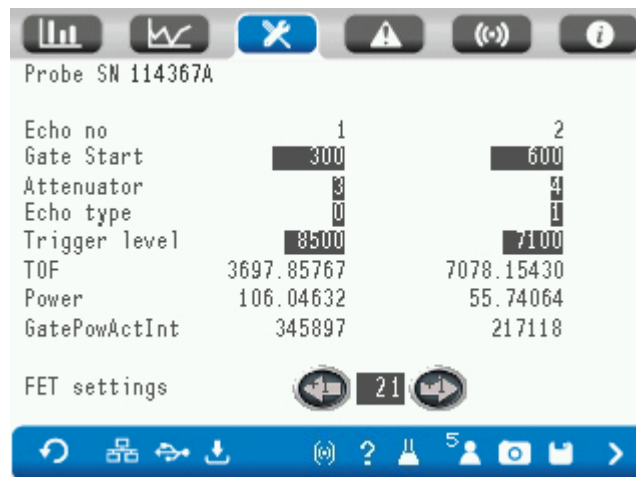
All settings of the echoes can be viewed in the Echo Settings. Advise the calibration sheet of the corresponding Probe SN about these settings. These settings should normally never change.

8.4.6 Pulser settings

All settings of the pulser can be viewed in the Pulser Settings. These settings should not change as the calibration will change.
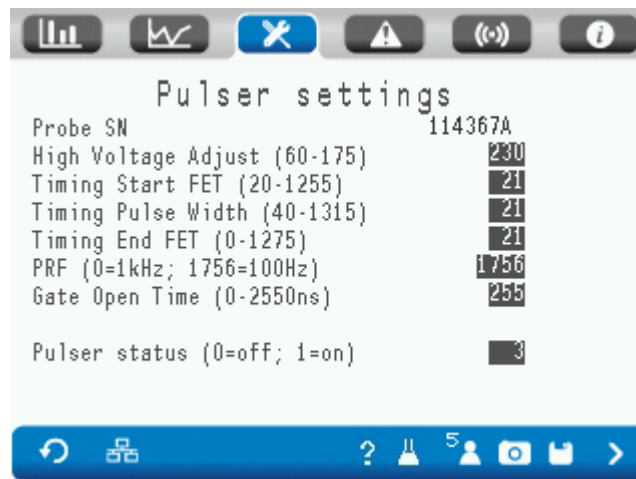
8.5 Attenuation Measurements Setup

The Attenuation meter is an alternative SDA that uses two probes to measure attenuation as the sound wave travels through the medium. From the attenuation, the TSS (g/l) can be determined. The corresponding home screen looks like this.

In order to access the attenuation setup, press the tools icon and go to Ultrasonic Density Transmitter. Press Attenuation Measurement button in the menu. The following screen will be shown.
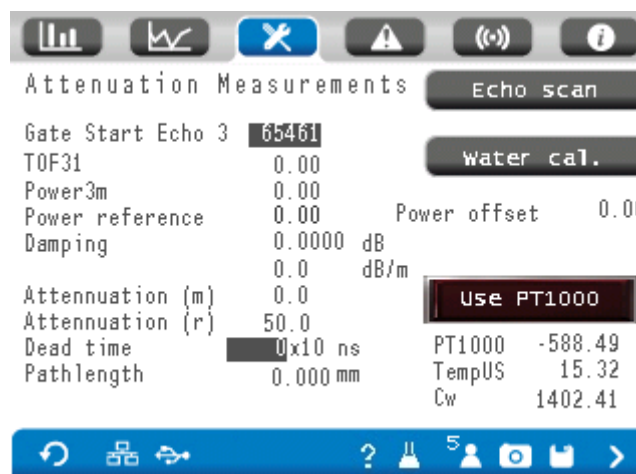
As soon as the analyzer is powered, the system performs an echo scan, to locate the echo. This procedure takes 1 second and can be done manually at any time by pressing Echo Scan button.

Note, however, that the system will respond very slowly when no echo can be found (e.g. when the system is turned on in air or with the sensors not aligned).

In the next screen, the echo locations will be shown. When an echo is found, the Found light will turn red. Press again to repeat the echo scan when no echo is found.
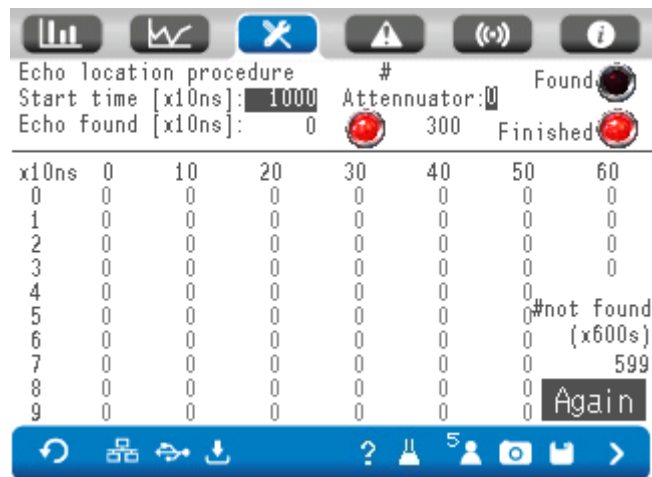
When the probes are installed in their final configuration (i.e. the distance and alignment between them will not change any more), a water calibration must be performed. Furthermore, a water calibration can be carried out at any time when desired.

During calibration, let clean water flow through the pipes and then press Water Cal. button. The power offset is calculated as the configuration of the probes may change the power recorded by the receiving probe. Furthermore, the pathlength between the probes will be determined.

Fill in the dead time according to the calibration certificate, if it is not filled in yet.

When the system is operational, multiple measurements are provided. These include the damping of the signal in dB and the attenuation m(odel) and r(esult). A Slurry Calibration should be carried out to obtain the correct TSS (g/l) value. The Slurry Calibration procedure is the usual one and can be found by pressing the TSS box on the main screen.

9. QT656-TMT – Thermal Massflow Transmitter

9.1 General Information

The Thermal Massflow Transmitter (TMT) sends a current through the Thermal Massflow Probe (TMP) to heat it and samples, digitizes, conditions and averages the analog measurement information. The information is stored in the Modbus registers to make it available to the SDA.

The SDA saves its measured values to its internal user memory. And according to the user Parameter setup, calculations are done on raw, digitized and filtered measurement values.

To control the TMT, the SDA runs a small program to receive the digitized, raw measured values, evaluate them, change settings in the TMT or starts an error.

The TMT is not hot swappable, so remove power from the SDA before connecting it to the TMT. Also first connect the Thermal Massflow Probe (TMP) to the TMT before powering up. Once powered up, it runs automatically.

9.2 Electrical connections

The connections on the QT65-TMT are:

A+	Modbus A+ line to QA03-SDA analyzer
B-	Modbus B- line to QA03-SDA analyzer
GND	Power ground from QA03-SDA
24 Vdc	Power 24Vdc from QA03-SDA
Force N	Forced current of the PT1000 CH1 or CH2 (-)
Sense N	Sense of the PT1000 CH1 or CH2 (-)
Sense P	Sense of the PT1000 CH1 or CH2 (+)
Force P	Forced current of the PT1000 CH1 or CH2 (+)
HTR GND	Power ground from **external 24V source**
HEATER 24V	Power 24Vdc from **external 24V source**
H GND	Power ground for TMP (thermal Massflow Probe)
H SenseN	Sense of TMP (-)
H SenseP	Sense of TMP (+)
H Force	Power 24Vdc for TMP

9.3. Setup Thermal Massflow Transmitter

In order to select the thermal massflow transmitter as input for velocity measurements, click the Flow block on the main screen to go to flow configuration. Follow steps 1 to 8.
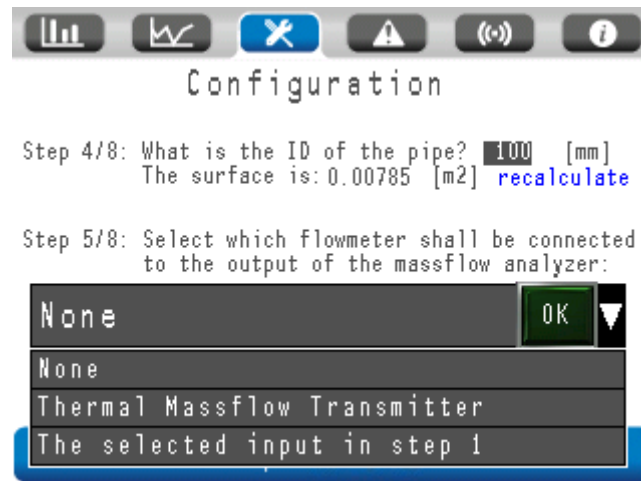
Step 1: If also an external flow meter is connect, select its source. In none, select "none".

Step 2: select the unit of this flowmeter, like m/s or m3/h

Step 3: Select its 20 mA value, assuming 4 mA is 0 m/s or m3/h.

Step 4: Enter the diameter of the pipe.

Step 5: Select which flowmeter shall be connected to the output of the massflow meter. Could be None, or the selected input in Step 1, or the Arenal Thermal Massflowmeter.

Step 6: Select the unit of this flow meter [m3/h] or [m/s].

Step 7: Select the range of the mA output

Step 8: Enter the walking average

9.4 Advanced Setup

For advanced setup, press the tools icon (Configuration Menu) in the top menu bar. Then, select Thermal Massflow Transmitter from the menu.

Configure Menu

Ultrasonic Density Transmitter

Thermal Massflow Transmitter

IO Module

System Settings
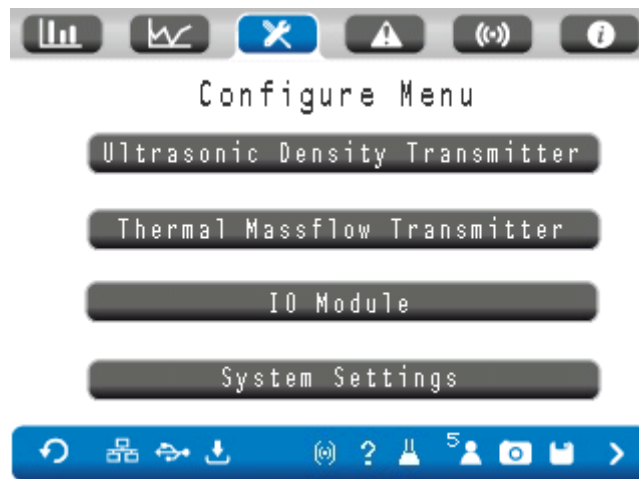
The following menu is shown after login.

TMT Transmitter

Measurements   Controller

Calibration   Modbus RTU
                    Communication

Slurry Calibration
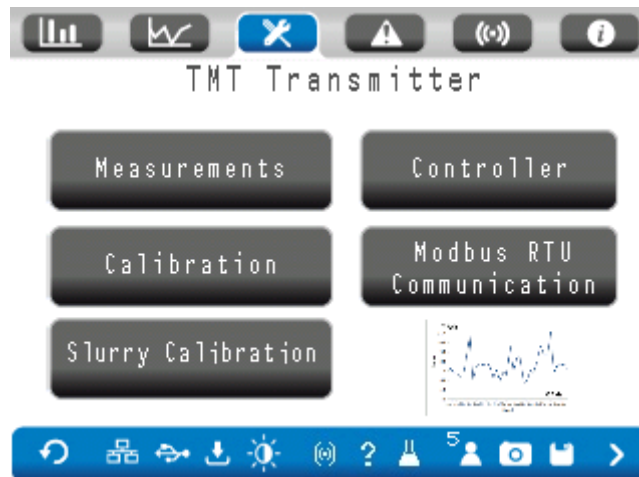
9.4.1 Measurements

Here, an elaborate overview of the measurements is shown. When the temp diff. shows in red, it means that the difference is too large.

Measurements

Status TMT/MFA: 0/ 0

PWM   0 / 1024
Current meas.   0.000 [A]
Voltage meas.   0.00 [V]
Power   0.00 [W]
Temp diff.   0.00 [C]
Massflux   0 [kg/m2/s]
Flow   0.00 [m/s]
                 0.00 [m3/h]
Density   1699.7 [kg/m3]
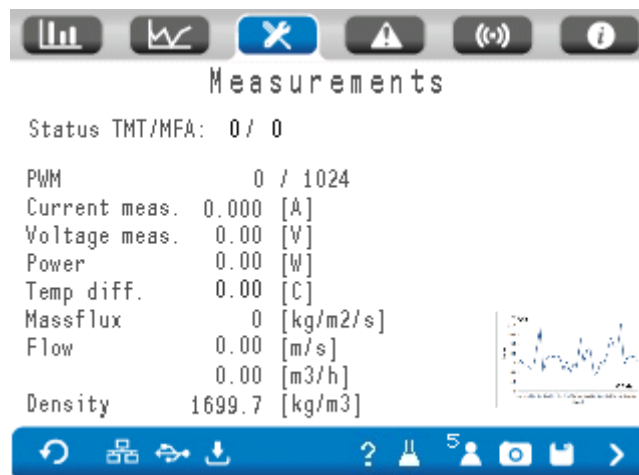
Press the Graph icon on the bottom right to show the current values of the controller.

9.4.2 Controller

In Controller, the settings regarding temperature difference can be found. Do not change those settings without consulting Arenal PCS.
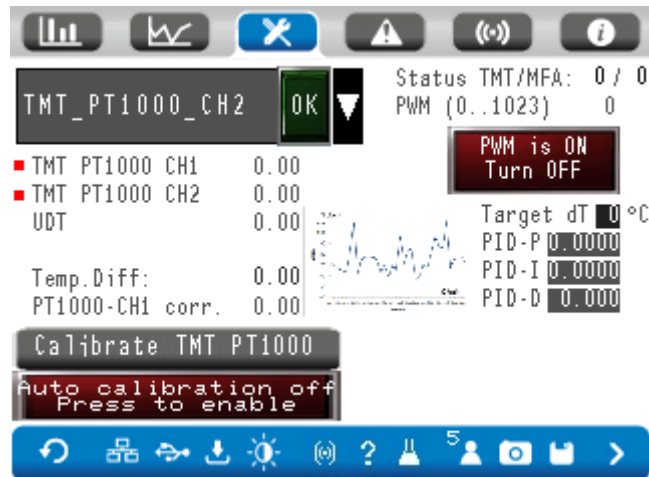
The small red squares on the left indicate to which temperature source the PT1000 in the TMP is compared to. The difference of the temperature is shown after "Temp.Diff:". The target for the temperature difference is shown on the right (target dT), along with the PID regulator settings. When the temperature difference is too large due to an erroneous calibration or wrong temperature source, temp diff is shown in red. The heater in the TMP is shut off to prevent overheating. When the issue is resolved and the temperature difference is small again, measurements will resume automatically.

Two buttons are shown. The button in the bottom right should show "PWM is ON". This means the flowmeter is heating up. When PWM is OFF, no measurements are performed. If this is the case, press the button to turn it on. Measuring will be resumed automatically.

The button on the left can be used to calibrate the PT1000 of the thermal massflow probe. **Before using this button, first press the button to turn OFF the PWM.** Then, wait until the temp(erature) diff(erence) stabilizes. The value should be around 0.00 degrees. When the value is stable, press Calibrate TMP-PT1000-1 to synchronize the temperature determined from the ultrasonic density probe and the PT1000 inside the thermal massflow probe.

9.4.3 Factory Calibration

In the factory calibration screen, calibration values for the TMT and TMP are shown. Those values are fixed and there is no need to change them unless advised by Arenal PCS.

The left column are values from the TMT, which should not be changed. These are the calibration constants of the electrical circuitry.

	Factory setting	Advised setting
Flow constant	0,33	0,3-0,5
Flow exponent	0,5	0,45-0,5
Density exponent, determined the thermal isolation coefficient of the slurry	0,17	0-1
Minimum PWM, shows 0 m/s when PWM becomes under this value.	30	0-50

PID stable range, when within this range of offset, controller stops adjustment	5%	5-10%
Max temp diff deviation. The measurement is not visible outside this range	10%	10-20%
Moving Avg, moving average	5	1-10
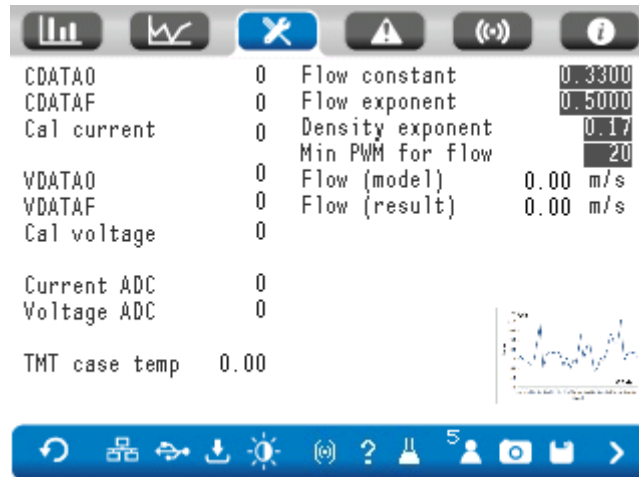
9.4.4 Modbus RTU Communication

This screen is only accessible for factory. In this screen, the Modbus RTU communication to the TMT can be switched on and off. When you plan to disconnect the TMT from the SDA, first switch off Modbus RTU communication as the device can become unresponsive due to a communication error when it cannot reach the TMT. Never turn on TMT communication when no TMT connected to the device.
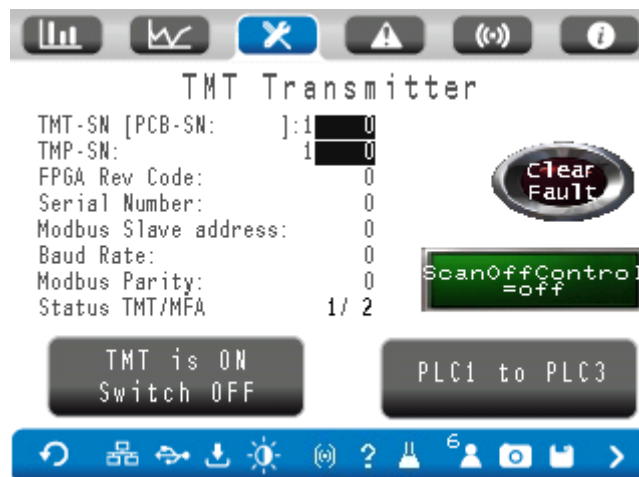
9.4.5 Slurry Calibration

The thermal massflow transmitter should be calibrated to ensure an accurate functioning. The sensor consists of the heating element and a PT1000. The energy consumption in the heater is accurately measured, so this would not drift. The PT1000 is protected from the slurry by a thick layer of ceramic and should also no drift. However, doppler measurements will drift, because erosion of the pipe. Magnetic flowmeters would drift because of wear of electrodes.

Comparing with the lab results is always a good idea. It is at this stage assumed that all other set-up parameters for the density meter and the Slurry Calibration for the density meter has been performed already. If not, please refer to chapter 3 and 4.

The Slurry Calibration corrects the flow reading and can be done online within a few minutes. There is no need to switch the system off or to remove any parts from the line.

The procedure for the calibration of the thermal massflow transmitter is slightly different from the ultrasonic density transmitter. A calibration must be performed on both water and (as high as possible density) slurry.

Press the Flow box on the main screen (to go to flow configuration) and then press the arrow at the bottom right. This will take you to the Slurry Calibration screen. Initially, it looks like this (one of both screens are in your software.

Explanation:
The flow will drop when more dense slurry is pumped. Depending on the thermal characteristics of the slurry, the value shall be corrected as follows:
At water the Arenal flowmeter shows 5,00 m/s, but a reference value (like transit time, magnetic or RPM says it is 4,50 m/s.
At slurry of 1350 kg/m3 the Arenal flowmeter shows 5,00 m/s, but a reference value (like doppler, magnetic or RPM says it is 4,20 m/s.

The result from model should show the current measurement value in both m/s and m^3/h. If not, please refer to chapter 10.3.2 (here, it is explained how to turn on the PWM in order to start the heater inside the thermal massflow probe). Calibration can be performed on both m/s and m^3/h values. Always make sure that you use only one unit for all calibration values (note that the maximum value that can be entered is 655.35). The calibration procedure for the thermal massflow transmitter is as follows.

a) Make sure there are no alarms on the display. If there are any alarms shown, please refer to the Alarm Section in this manual to resolve them first before the Slurry Calibration is attempted.

b) Pump process water through the pipe. Wait until the density model value is stable.

c) Fill in the density model value shown on the screen for Water – Density model. This value should be approximately between 997 and 1000.

d) Enter the result from model for Water – Online value. For Water – Lab value, enter the value provided by the laboratory or a reference meter.

e) Now, pump slurry through the pipe. Wait until density model is stable.

f) Fill in the density model value shown on the screen for Slurry – Density model.

g) Enter the result from model for Slurry – Online value. For Slurry – Lab value, enter the value provided by the laboratory or a reference meter.

h) Press the stiffy icon to save the calibration.

10. QM132-IOM and QM138-IOM

Analog in- and outputs are controlled by the QA03 PLC as well as the IO Module. In case the IO module is not connected, only one mA input, two mA outputs and 3 digital open collector outputs are available. In case the IO Module is connected, two additional mA inputs and four mA outputs are available. All available outputs are described in this section.

10.1 General information of the QM138-IOM

The Arenal Modbus Serial I/O Module operates as a Modbus RTU slave device when connected to the baseboard of the analyzer. The IOM is a general-purpose data acquisition or DAQ card that is multi dropped onto a serial 2-wire RS485 link to a Modbus Master, the ProFace PLC.
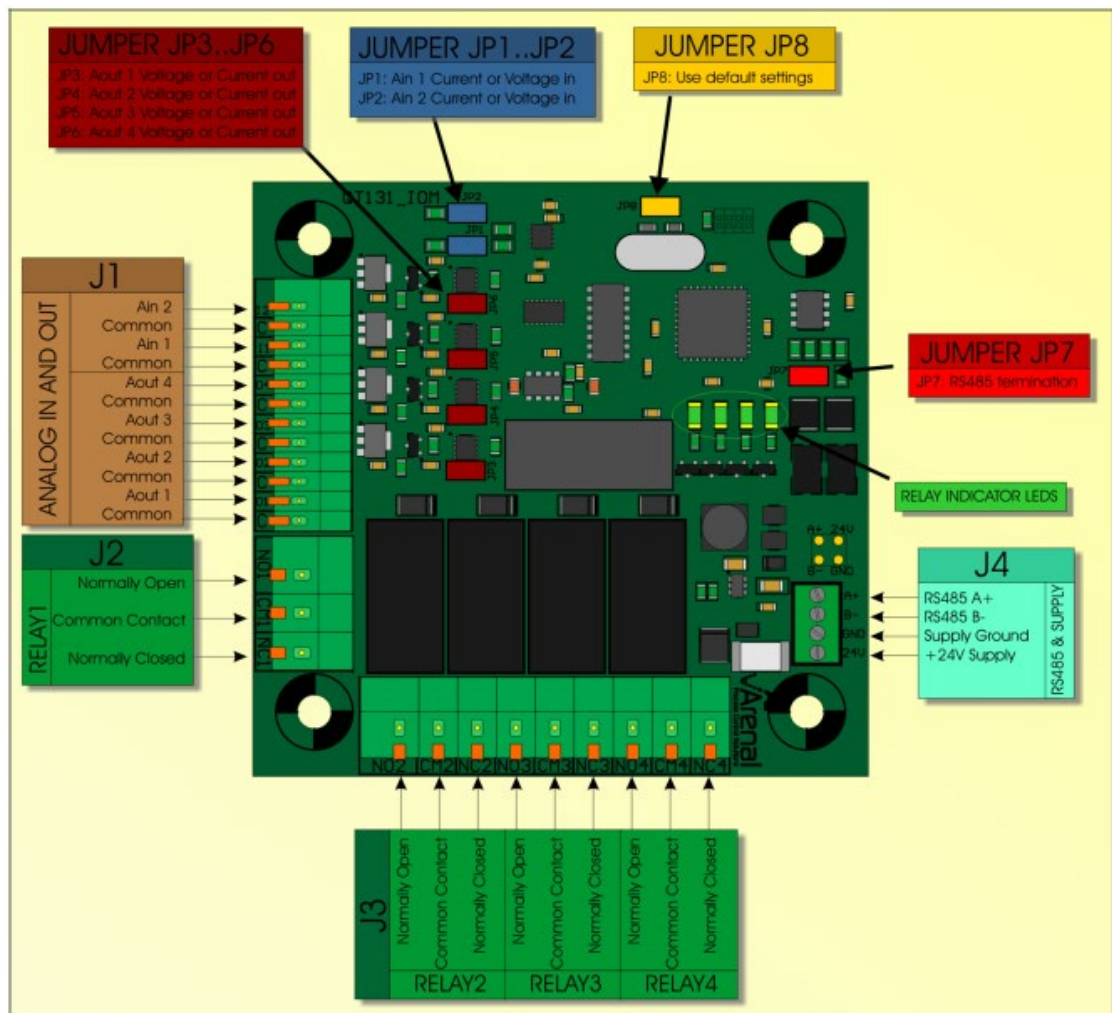
The module features
· 2x 16 bit Analog Inputs 4-20mA or 0-20mA or 0-5V, galvanically isolated from the PCB
· 4x 16 bit Analog Output 4-20mA or 0-20mA or 0-5V, galvanically isolated from the PCB
· 4x Relay outputs (3A at 240VAC)

10.2 Set-up

To set-up the IOM, go to the Configuration Menu and press "IO Module". Depending on which IO module is selected (in Modbus RTU Communication), various options are available.
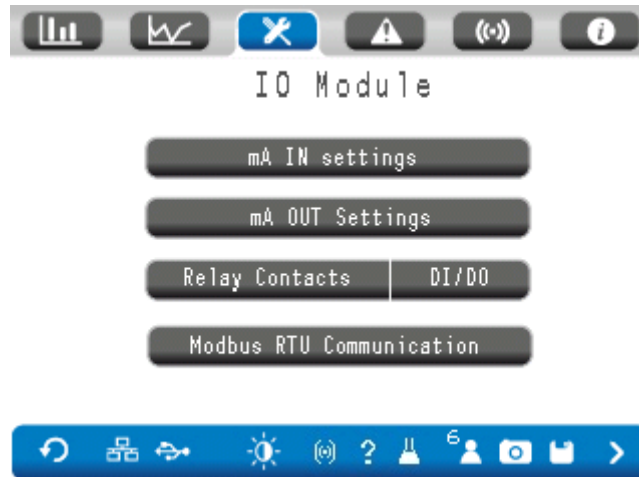
10.2.1 Menu bar: mA IN Settings

Press "mA IN Settings" in the main menu. After connecting a mA to the IO module, these signals are digitized and can be read out immediately:

Insert the unit and the range for the 20 mA signal. Initial Span shall be at 1.0. To test what happens with a imaginary mA input, enter a value of choice in "Test mA"
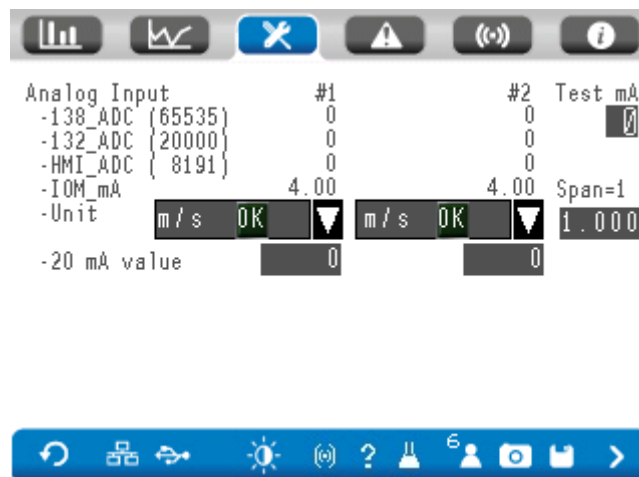
10.2.2 Menu bar: mA OUT Settings

Maximum 2 mA output signals can be configured in the IOM. Select the parameter of interest for the selected output channel, like SG connected to the AO-1. Flow to AO-2.
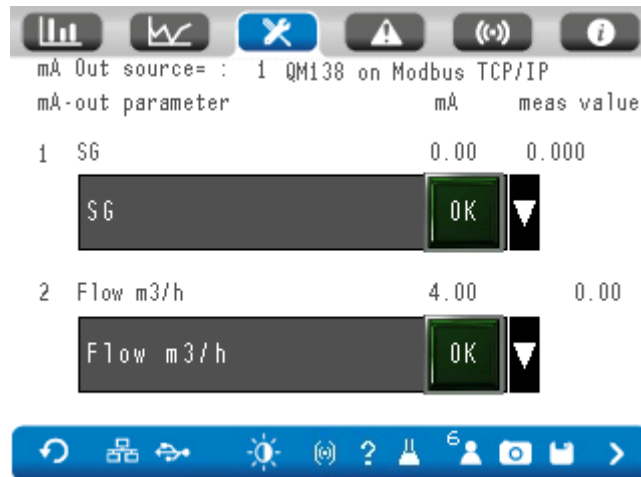
10.2.3 Menu bar: Relay Contacts

These are only available when the QM138-IOM is available and selected.
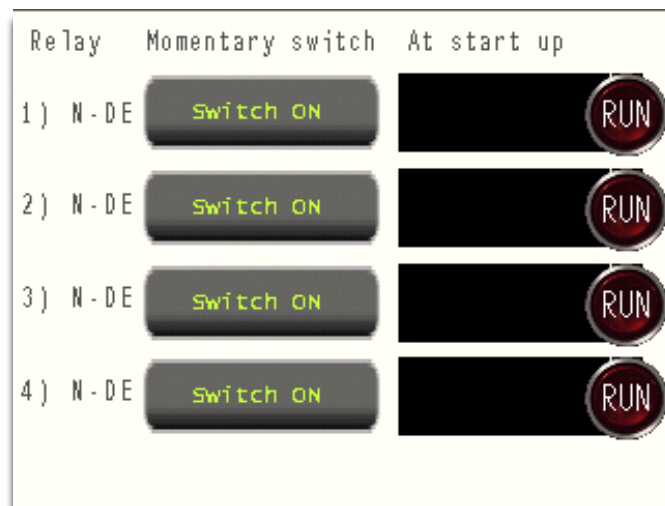
This module offers 4 galvanic isolated relay contacts, all NO, NC, energized or de-energized selectable.

10.2.4 Menu bar: DI/DO

The QM132-IOM and the LT4301 display has digital inputs and outputs.

In this screen the status of each is shown. The lamps will turn ON when high.

Select the pulse output width for specific connections with other PLC's.
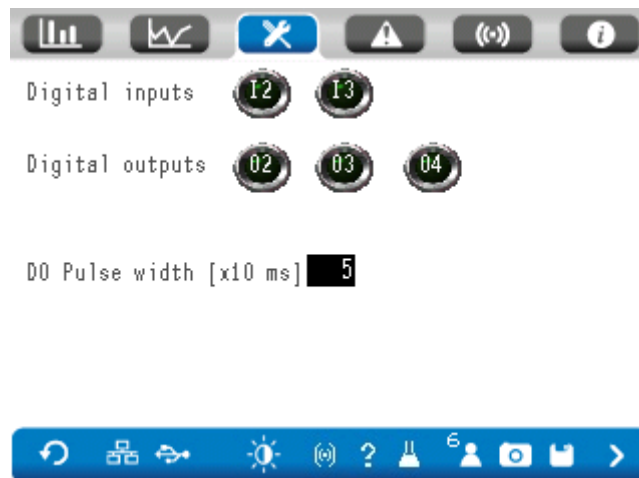
The tonnage Dry Solids is available on the open collector output, as per Installation Manual. For each ton produced dry solids, a pulse is provided on the output.

10.2.5 Menu bar: Modbus RTU Communication
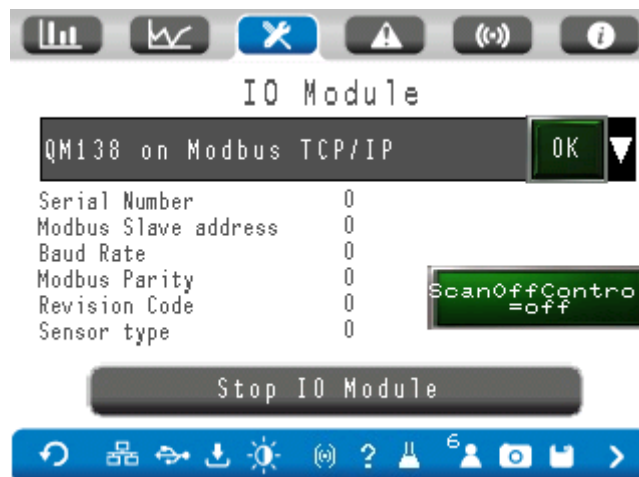
The slave address of the IOM is 13.
This screen shows the current communication settings. If the IOM status is 0 or 9, it makes sense to start or restart the IOM. Note that starting the IOM without a physical connection, can make the system stop and difficult to recover.

10.3 Ground loops

When connecting an externally powered 2-wire 4-20 mA signal, be warned about ground loops! Avoid ground loops: they can have influence measurement results. Here is some information how this works and how it can be solved:

The IOM has two passive mA inputs. That means that no power is provided to a loop, but only measure the current that is streaming through the connectors. A difference in power and in grounding, can cause ground loops that affect mA inputs.

Secondly, when the distance between transmitters and receivers increase, the ground resistance increases, due to the resistance in the cable. Many transmitters require a 'ground' potential for their measurement, and many transmitters are not protected from ground currents leaking into the system. So good grounding is a big issue.

In the third place, mA transmitters are powered by 24Vdc, but sometime a HF ac current is applied to the power supply, due to bad design. These HF currents can influence the isolation barrier in the IOM.

The cure is called "isolation" and "filtering".

Isolating each single mA in- and output is not always needed but very costly, so Arenal isolated only the mA signals from the Modbus convertor, so that big failures on the mA lines cannot harm the rest of the network. HF signals can influence the isolation properties.

Ground loops are a common problem in instrumentation and several solutions can be found.

1. Power the mA transmitter and receiver by the same power supply. We have 24Vdc available in the IOM or in the analyzer.

2. Install a common mode filter, which reduce HF current frequencies, in the mA connection cable, like:

   1. Würth, 27MH, 0.4A (Farnell: 1748631)

   2. Würth, 39MH, 0.4A (Farnell: 1748632)

3. If this cannot be done, install a galvanic isolator. First test the common mode voltage of the mA transmitter: take a voltmeter, set it to the DC Volts scale and measure between earth ground on the recorder and the disconnected, freestanding positive wire from a transmitter. Do the same for the negative leg. Report back to Arenal PCS.

   Then select a "loop isolator" or "analog isolation amplifier/barrier" from the list below:

   1. WAGO 857-400. Farnell 1630505 around Euro 550

   2. Drago DN28 P-12. 89 euro. Power it from the IOM

11. QM146-RMM – Remote Monitoring Module

This chapter is left open intentionally. Will be filled with information about the RMM shortly.

12 TCP/IP Register

The HMI can be approached via a TCP-IP connection. Via the Modbus register, the user can obtain measurement values and interact with the HMI.

12.1 Results of the parameters

You can read several measurement values from the Modbus register of the HMI using the TCP-IP protocol. Values are available as float or integer (the latter must be converted using a conversion factor to obtain the correct value).

Note that for addresses containing 2 words, the low word is stored before the high word. For example, if the shift solids production is 3578955 tons, address 40218 contains the word 9C4B and address 40219 contains the word 0036 (in hexadecimal).

If you like to receive the measured data by external PLC, then you can refer to the Modbus addresses as listed below:

Modbus register	Size (words)	Data type	Multiplication factor	Discription
400100	2	Integer	N/A	Dredging counter
400102	2	Float	N/A	SG
400104	2	Float	N/A	Density (kg/m^3)
400106	2	Float	N/A	TSS
400108	2	Float	N/A	Temperature (Celcius)
400110	2	Float	N/A	Massflow solids (mA)
400112	2	Integer	1	Massflow solids (t/h)
400114	2	Float	N/A	Massflow slurry (mA)
400202	2	Integer*	100000	SG
400204	2	Integer	1	Density (kg/m^3)
400206	2	Integer*	100	TSS
400208	2	Integer*	100	Temperature (Celcius) UDT
400212	2	Integer*	1	Massflow solids (t/h)
400216	2	Integer*	1	Massflow slurry (t/h)
400218	2	Integer*	100	Flow (m/s)
400220	2	Integer*	100	Flow (m^3/h)
400230	2	Integer	1	Shift solids production (t)
400232	2	Integer	1	Shift slurry production (t)
400240	2	Integer*	100	mA input 3 (flow)
400242	2	Integer*	100	mA input 4
400244	2	Integer*	100	mA output 5
400246	1	Integer*	100	mA output 6
400248.00	1	Bit	N/A	Digital output 2 (SG low alarm). 0: no alarm 1: alarm
400248.01	1	Bit	N/A	Digital output 3 (SG high alarm) 0: no alarm 1: alarm
400248.02	1	Bit	N/A	Digital output 4 (Dry tonnage) 0: no alarm 1: new ton dry solids produced

400250				Uptime of HMI in seconds. When 0, system is down

* Note that the integer values must be _divided_ by the multiplication factor before obtaining the correct value.

13. Maintenance, Troubleshooting & Support

This chapter lead you through the most common maintenance and troubleshooting topics. When you are unable to solve the problem using the manual, please contact Arenal PCS through the service request form that can be found on https://www.arenal-pcs.com/service-request.html. Note that service fees may be applicable when the issue is not caused by a manufacturing defect.

13.1 Arenal/ProFace Software and firmware configuration

The software of the SDA is frequently updated. When new evaluations take place, it is easy to update the software and to make use of the new possibilities.
Besides, it is easy to get remote support from Arenal. In this chapter all questions should be answered.

The SDA contains of two layers of software:
1) The Pro-Face HMI software. This software is on all Pro-Face PLC's or HMI's and contains settings, which are needed to control all IO, IP addresses and security passes. We use this software layer to update our software and to change IP address. This layer can be reached by tipping your finger first to the top left of the screen, then the bottom right, top left again, bottom right again, until a grey menu bar is activated in the bottom of the screen. This software is never updated.
2) The Arenal software, which is running the program with the measuring screens. All Arenal SDA's have the same software, but sometimes it can be updated. This program is securely stored in the inner memory of the HMI. The Arenal software is updated with new and improved functions almost weekly, but it is not always needed to update. A list of improvements is available and which can be compared to your current software. Software updates are free of charge.

Besides this software, the firmware in the transmitter is sometimes improved. The firmware can only be updated at Arenal R&D Facility. As the SDA read and writes to these transmitters, a software update of the SDA may be required as well.

13.2 Updating Arenal Software

If you are about to update the software, then first stop the logger, otherwise the last data is not stored on the USB stick. Unsaved data from parameters cannot be recovered, so save this data as well.

Make a backup copy of the USB stick, compress it into a zip file and send it to Arenal. Arenal uses the settings to validate the software, so that no problems occur in the field.

Warning: variables in the internal memory will be lost when updating the software.

Keep the power of the system on. Do not disconnect transmitters: keep it all connected.

For updating the current software, an extra password is supplied by Arenal. When updating, the old software is removed from the HMI and cannot be recovered anymore.

Once you updated the system, it will immediately start measuring.

1. Updating software is done with the USB Stick. Press the USB icon on the analyzer, and press "Remove USB". Once the green checkmark shows, remove the USB stick from the HMI.

2. Download the zip file from WeTransfer.com that we have send you. Extract the zip file to the root of the USB stick. The size is about 16 MB.
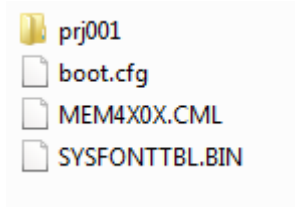
3. Insert the USB stick in the SDA. The SDA will recognize it and the button on the screen flashes. Now you need to go to the ProFace Offline modus. As no physical buttons are available: a screen push method is available: press with one finger in the upper left corner and then immediately in the bottom right corner of the display, all within 0.5 seconds:
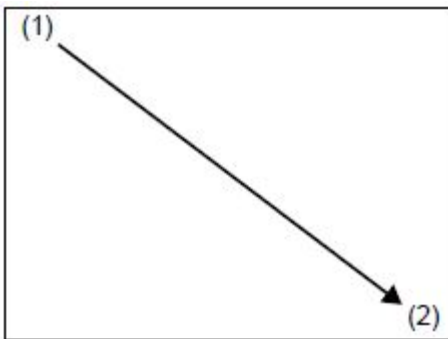
Do not swipe, but press two times: one time left top, one time right bottom. Repeat when not successful. When successful: the system menu (or a look-a-like) on the bottom is displayed:

4. Go to the next page(s) with the arrow key to find the button "SD/USB". Press it and a new menu opens. Press "USBStart". The following menu opens:
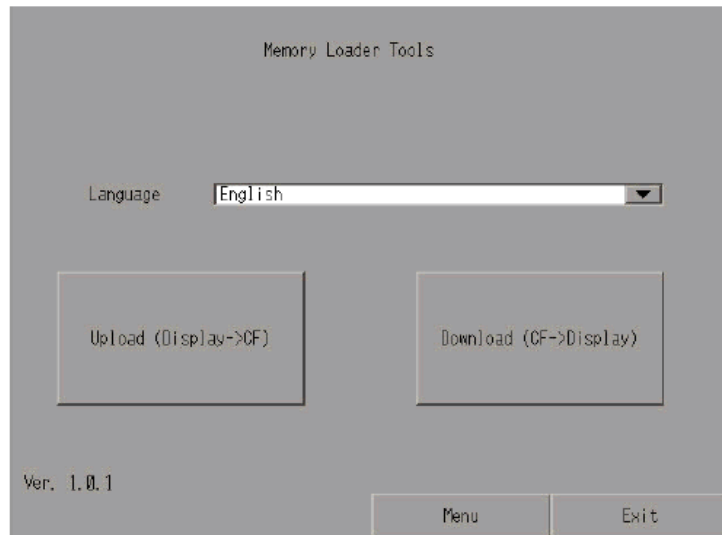
5. Select the English language and then "Download" to download the software from the USB to the Display.
6. Press the white bar to enter the Password that was given by Arenal (capital sensitive!) and press ENT (Enter) after finishing. Press "Start" to start the process.
7. If asked: "Do you want to download the data?", press "Yes".
8. Updating software takes less than 1 minute. After successful update, press "Back", "Back" again, "Exit" and "Yes". Check in the information screen (serial number) the current software version (SW version), which should be the same as the number of this manual.

13.3 How to get Remote Support

Arenal offers Remote Support when the software or application files does not do the expected things. We offer three ways of support:

1) By GSM/GPRS Module QM146-RMM Remote Monitoring Module

2) By VPN connection

3) By AnyDesk

13.3.1 QM146-RMM

When the QM146-RMM is connected to the HMI, Arenal is able to take over control of the HMI. Download the quick set up manual from the internet to learn more.

13.3.2 VPN Remote Control

When the SDA is connected to an external VPN Modem, we can take over control of the analyzer and check the causes of the problems. More info can be requested at Arenal.

13.3.3 AnyDesk

TeamViewer is easier to get access to the system, but lacks all security. The benefit is that we can discuss by Skype the problems and the way it can be solved. Herewith the instructions to follow:

Your laptop must have installed GP Viewer EX trial software from Pro-Face. Ask Arenal PCS for assistance.

3. Connect the laptop to the Pro-Face PLC or HMI by a LAN cable. Start up GP Viewer Ex.
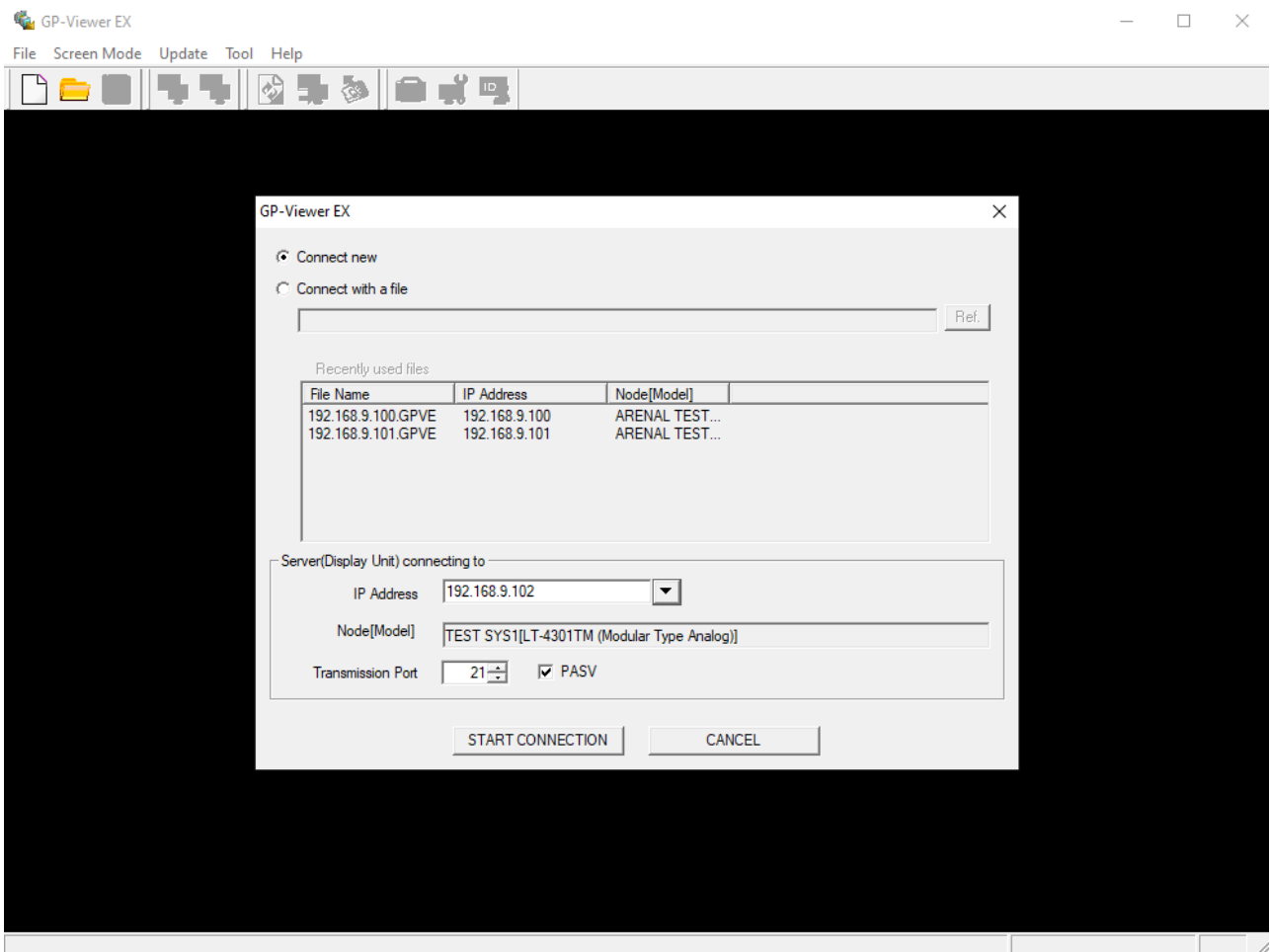
2. Enter the IP address of the SDA into the corresponding field (in the range 192.168.9.x). Check the field PASV. To check the IP address, go to the offline menu, see chapter 9.

    a) If a connection cannot be made, check the properties in your laptop's Internet Protocol version 4 (TCP/IP). Use the following IP address: 192.168.9.1 and subnetmask: 255.255.255.0.
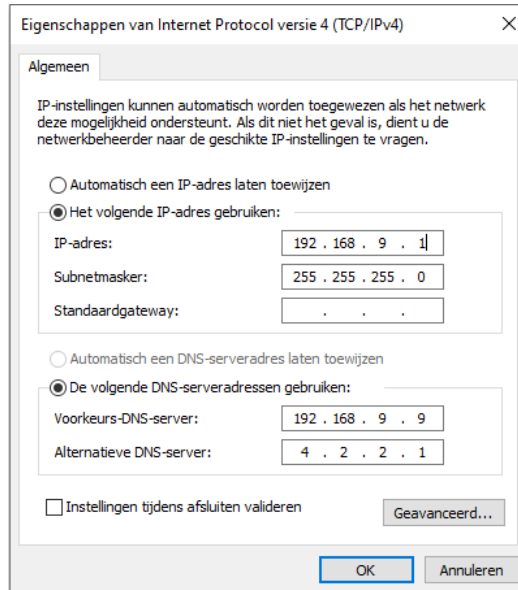
3. Enter the password, the same as for installing new software.

4. Enter the user's service level and password.

If Arenal takes over your PC by TeamViewer, only the echo's cannot be transmitted: if asked, please make a picture and send by WhatsApp.

If the session is finished, do not forget to restore the LAN IP setting of your PC to the automatic mode.

13.5 ERROR CODES

This part of the manual will assist you during faults that service engineers may face when using the SDA. Typically, errors that occur are due to 1) the operation of the SDA, 2) Communication with the transmitters, 3) Wrong settings, 4) Internal software failures. Arenal uses his own error-handling procedure, but still keeps using the Pro-Face internal error handling system.

ERROR CODES FROM THE PROFACE SOFTWARE RAAA errors are due to an error in the application; RHAx errors are due to communication problems with the transmitters;			
ERROR CODE	Meaning	Problem	Action
RAAA014	Failed to start from USB storage.	The file required for startup from the USB storage device does not exist. Or the necessary file may have an error. Check that the startup file "boot.cfg" and the "pj001" folder are located directly under the USB storage. The USB storage startup program may be damaged.	Check the directory and file structure on the USB with the manual. Request a new file from Arenal
RAAA054	Backup data has been erased	Data in the backup memory (SRAM) has been deleted due to the backup battery running out. Due to a failing upgrade of the software the backup data is erased.	
RAAA102	Failed to read from the Device/PLC	The SDA cannot communicate with a transmitter.	Check the cabling, power supply of the transmitter.
RHAA007	General Modbus SIO	Received data on the Modbus RTU line has a framing error, which means lack on receiving data. The cause is noise or loose connection.	First check if there is a failing connector. Then check if all transmitters that are set up in the parameters are connected. At a jumper (connector) on JP1 on UDT if this is last transmitter in line. Or at last add a End Resistor of 100 Ohm on the last transmitter.
RHAA068	PLCx	Response timed out for device read command.	A communication error on the COM2 port (RS485

			Modbus RTU) prevents the unit to work. Please report the details of the error.
RHAA069	PLCx	Response timed out for device write command.	A communication error on the COM2 port (RS485 Modbus RTU) prevents the unit to work. Please report the details of the error.
RHAA073	PLCx	Illegal write request because this device has been off scan.	A write instruction was given to the transmitter, while it was actually disabled. This is a software error and can be fixed. Please report the details of the error and a software update shall be issued. Meanwhile, turn on the transmitter.

13.6 FAQ and Troubleshooting

Find a solution for FAQ's:

13.6.1 The screens does not show a language or a wrong language

This can happen after an update of the software, as in this case the internal memory is reset. But how to find the language settings, if no words are displayed in the menu bars? In that case we advised to compare the actual display with the manual. This will lead you to the System Settings Menu, then User Settings and the language. Once set, save the setting and it cannot happen again.

13.6.2 The menu has a wrong color

If this happens, the color is then Red and the information screen refers to Arenal. This can happen after an update of the software, as in this case the internal memory is reset. Go to the System Settings Menu, then User Settings and change the color. Once set, save the setting and it cannot happen again.

13.6.3 The logging data is not stored on the USB stick

If you have set the logger on the SDA will log all the data in its internal memory. When the logger is set OFF, this data is stored to the USB stick in directory "Sampling". In addition, the data is stored to the USB stick when the internal memory is full. When you cannot find the data on the USB stick, then writing to the USB stick failed. It could be that the USB stick is in the LOCK position, or that the USB stick is not ok.

13.6.4 The mA signal does not give a value

Check the corresponding value in the Configuration Menu/ mA outputs. If the output has a specific mA value, like 4 mA, then it should be available on the mA signal. If not, check all cables.

13.6.5 The HMI does not work.

Check if there is 24Vdc power available at the fuse in the analyzer, before and after the fuse. If so, remove the power connector of the analyzer and measure the power there as well, also 24Vdc. If so, measure the power at the entry of the HMI, also 24Vdc. If so, reconnect that connector. If you hear a beep sound, the HMI works. Go to the Offline menu and set the brightness to a higher level. If that is not working as well, the HMI is defective. We have units on stock, as for a replacement.

13.7 Software log history

The log history is supplied with the updates of software.

14 Warranty

14.1 Probes

The ceramic and metal slurry density probes are consumables with an expected lifetime of 10 year. Lifetime will be lowered due to the technology developments, wear and vibrations. The internal parts however are made according to highest standards and have a life expectance of 10 years in clean and simple fluid applications. Since the probes are used in extreme conditions and in most cased usage cannot be controlled the warranty on a probe is 6 months after commissioning by an Arenal appointed service engineer with a maximum of 1 year from invoice date. For the use in abrasive and turbulent fluids, warranty can be given under specific conditions:

Warranty can be claimed for all SIC sensors that were flush mounted in the process.
However, when the sensor was intruded in the slurry, no warranty can be claimed. In that case, the tip of the sensor can chip off, due to wear of the wafer cell or pipe ID. Customer shall check regularly the wear of the pipe and the reduce the intrusion of the sensor. Leniency is in this case given for 6 months after supply: 50% discount on a new sensor.

Warranty can be claimed for all SIC sensors that were mounted 5x internal pipe diameter after last obstruction.
When the sensor was mounted before 5x internal pipe diameter after last obstruction. A high turbulence could influence the reading of the sensor and also effect wear. No leniency is offered.

Warranty can be claimed for all sensors that were defective on its fixed cable within 6 month after supply. However, when the sensor is re-located after the first commissioning within 6 months, no warranty is given.

14.2 Transmitters

Transmitters in the field, like Ultrasonic Density Transmitter (UDT) shall not be opened anymore after commissioning. Its electronics is sensitive for moist, dust and electrostatic discharge. Best practice is to protect this transmitter by tape.
In some cases, it happened that FETs break without reason. In that case, you hear a clipping noise. You can shut off the instrument and ship it back within the original housing.
Warranty is given for all UDT's that break during the first 24 months after invoice date.
However is some cases Arenal does not give warranty:
- When the unit is commissioned without an appointed commissioning engineer of Arenal.
- When the Modbus driver of the UDT is defective: that is caused by wrong cabling
- When the electronics of the UDT are damaged by moist, dust or electrostatic discharge, or shortage caused by wrong handling.

14.3 Analyzers

Analyzers are warranted for 24 months after invoice date. However is some cases Arenal does not give warranty:
- When the unit is commissioned without an appointed commissioning engineer of Arenal.
- When the Modbus driver of the HMI is defective: that is caused by wrong cabling

14.4 Performance of the application

The slurry density analyzer suits most or all mineral processing slurries. In case the application does not work well, a service request can be filed via https://www.arenal-pcs.com/service-request.html. If the issue

is related to a manufacturing defect and Arenal cannot solve the issue, the system can be returned for 75% money return within 24 months after supply.

In case sets of systems are mixed up, USB sticks are lost, cables are changed or any other issue not caused by a manufacturing defect, the service rate applies and warranty is not applicable on the application.

In case it is unclear what happened, Arenal will discuss with distributor how to solve the issue.

A1 Declaration of Conformity

Date: April 20, 2016

Application of Council Directives: EMC Directive (2004/108/EC)

                                                            Low Voltage Directive (2006/95/EC)

Standards to Which Conformity is Declared: EN61010-1:2010

Manufacturer's Name: Arenal Process Control Solutions BV
Manufacturer's Address: Boezemweg 23H
                                                            2641 KG Pijnacker
                                                            The Netherlands

Product Name: Ultrasonic Density Analyzer

Model Numbers: QA03-SDA-DIS-VAC-XXX-XXX
                                                            QA03-SDA-DIS-VAC-IOM-XXX
                                                            QA03-SDA-DIS-VAC-XXX-UDT
                                                            QA03-SDA-DIS-VAC-IOM-UDT
                                                            QA03-SDA-DIS-VAC-XXX-PORT

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Marius de Vries
CEO of Arenal PCS B.V.

Arenal Process Control Solutions BV
Boezemweg 23-H
2641 KG PIJNACKER
The Netherlands

Tel: +31-153010071
www.arenal-pcs.com
info@arenal-pcs.com
Chamber of Commerce Den Haag : 54416493

A2 Service support rates

Arenal offers remote monitoring service support and local assistance. Some of these services are free of charge, most are against our service rate tariff.

For remote commissioning work, the first 4 hours are free of charge. This work includes:
- Checking pictures for installations and wiring.
- Giving step-by-step instructions until power up.
- Data evaluation after 1 week of monitoring.

Other services are against hourly rate or contractual rate. This includes:
- Design of wafer cells, spool pieces and assemblies for local production
- Slurry Calibration assistance
- Revise probe calibration with calibration sheet
- Remote Monitoring by GP-Viewer/TeamViewer or VPN
- Service support on site
- Training
- All other services

The price list includes rates for service support KWR-5PL019-Q1 Price list.

A3 ISO-9001:2008 certificate

CERTIFICAAT

Nummer: 2183182

Het managementsysteem van:

Arenal Process Control Solutions B.V.
Boezemweg 23h
2641 KG Pijnacker

en de toepassing daarvan voldoet aan de voorwaarden gesteld in:

ISO 9001:2015

Voor het toepassingsgebied:
ontwikkelen, produceren, verkopen en onderhouden van procesanalyse apparaten

Dit certificaat is geldig tot: 1 februari 2019
Dit certificaat is geldig vanaf: 28 augustus 2018
Gecertificeerd sinds: 1 februari 2016

DEKRA Certification B.V.

drs. G.J. Zoetbrood
Directeur

R.C. Verhagen
Certificatie Manager

© Integrale publicatie van dit certificaat alsmede de bijbehorende rapporten is uitsluitend in hun geheel toegestaan.

DEKRA Certification B.V. Meander 1051, 6825 MJ Arnhem Postbus 5185, 6802 ED Arnhem, Nederland
T +31 88 96 83000 F +31 88 96 83100 www.dekra-certification.nl Handelsregister 09085396

A4 Electrical diagram QA03-SDA-DIS-VAC-IOM-UDT

mA out from HMI
E1 (yellow) = HMI connector D14
E2 (green) = HMI connector C15
E3 (white) = HMI connector D14
E4 (brown) = HMI connector D15

HMI POWER to HMI

COM1 to HMI COM

Relay output 3A 30v- / 277V~
From top to bottom:
NC4 = Normally closed Relay 4
CM4 = Common Relay 4
NO4 = Normally open Relay 4

NC3 = Normally closed Relay 3
CM3 = Common Relay 3
NO3 = Normally open Relay 3

NC2 = Normally closed Relay 2
CM2 = Common Relay 2
NO2 = Normally open Relay 2

NC1 = Normally closed Relay 1
CM1 = Common Relay 1
NO1 = Normally open Relay 1

QT016X-UDT
(Power and
Modbus RTU)

24V
GND
B-
A+
Modbus RTU

SIGin GND

Probe
SIG in = Coax core
GND = Coax shield

E1 E2 E3 E4

-F -S +S +F

Probe
PT1000

4-20mA out
E1 = GND
E2 = 4-20mA Density
E3 = GND
E4 = 4-20mA Temp
(SDA) / Flow (for MFA)

Analog in and out, galvanical isolated
Ain2 = Input 4-20mA or 0-5V
AGND = GND for Ain2
Ain1 = Input 4-20mA or 0-5V
AGND = GND for Ain1
Out4 = Output 4-20mA or 0-5V
AGND = GND for Out4
Out3 = Output 4-20mA or 0-5V
AGND = GND for Out3
Out2 = Output 4-20mA or 0-5V
AGND = GND for Out2
Out1 = Output 4-20mA or 0-5V
AGND = GND for Out1

JP1 to JP6 (Jumpers)
Jumper placed = 0-5V
Jumper removed = 4-20mA
JP1 = Ain1
JP2 = Ain2
JP3 = Aout1
JP4 = Aout2
JP5 = Aout3
JP6 = Aout4

Fuse

Spare Fuse

Power in
100-240Vac
50-60Hz

N L

PE

Partname: QA03-SDA-DIS-VAC-IOM-UDT
Drawingname: KWR-7QA03-412A

Productdrawing

Arenal PCS The Netherlands
Electrical diagram inc IOM UDT

description::

projection:

Arenal
Process Control Solutions

Drawing for information only.
Strictly confidential!

name: date:
drwn: Ir. J. v Winden   07-07-2021
chkd:
appr:

File: KWR-7QA03-412A

File location:: D:/R&D besien/gen/KWR-7QA03\

pr. weight:
gr.
material:

A5 Electrical diagram QA03-SDA-DIS-VAC-IOM-XXX

mA out from HMI
E1 (yellow) = HMI connector D14
E2 (green) = HMI connector C15
E3 (white) = HMI connector D14
E4 (brown) = HMI connector D15

HMI POWER to HMI

COM1 to HMI COM

Relay output 3A 30v~ / 27V~
From top to bottom:
NC4 = Normally closed Relay 4
CM4 = Common Relay 4
NO4 = Normally open Relay 4

NC3 = Normally closed Relay 3
CM3 = Common Relay 3
NO3 = Normally open Relay 3

NC2 = Normally closed Relay 2
CM2 = Common Relay 2
NO2 = Normally open Relay 2

NC1 = Normally closed Relay 1
CM1 = Common Relay 1
NO1 = Normally open Relay 1

Modbus RTU

24V
GND
B-
A+

QTO16X-UDT
(Power and
Modbus RTU)

E1 E2 E3 E4

4-20mA out
E1 = GND
E2 = 4-20mA Density
E3 = GND
E4 = 4-20mA Temp
(SDA) / Flow (for MFA)

Analog in and out, galvanical isolated
Ain2 = Input 4-20mA or 0-5V
AGND = GND for Ain2
Ain1 = Input 4-20mA or 0-5V
AGND = GND for Ain1
Out4 = Output 4-20mA or 0-5V
AGND = GND for Out4
Out3 = Output 4-20mA or 0-5V
AGND = GND for Out3
Out2 = Output 4-20mA or 0-5V
AGND = GND for Out2
Out1 = Output 4-20mA or 0-5V
AGND = GND for Out1

JP1 to JP6 (Jumpers)
Jumper placed = 0-5V
Jumper removed = 4-20mA
JP1 = Ain1
JP2 = Ain2
JP3 = Aout1
JP4 = Aout2
JP5 = Aout3
JP6 = Aout4

Fuse
Spare Fuse

Power in
100-240Vac
50-60Hz

N L

PE

Partname: QA03-SDA-DIS-VAC-IOM-XXX
Drawingname: KWR-7QA03-411A

Productdrawing

Arenal PCS The Netherlands
Electrical diagram incl IOM

description:

name: date:
Ir. J. v Winden   07-07-2021

dtwn: Ir. J. v Winden
chkd:
appr:

pr. weight:
gr.
material:

id. number:
mouldnumber:

scale: units: size:
1:1   mm   A3

sheet 1 of 1.

rev/sion:

REV A   30-8-2021

code: date: by:
                                 JWN

general
tolerance
acc. to
DIN ISO 2768-1

0 - 3 mm ± 0.10 mm
3 - 6 mm ± 0.10 mm
6 - 30 mm ± 0.20 mm
30 - 120 mm ± 0.30 mm
120 - 400 mm ± 0.50 mm

projection:

File location: D:\R&D releasing.ser\KWR-7QA03\
File: KWR-7QA03-411A

A6 Electrical diagram QA03-SDA-DIS-VAC-XXX-UDT

A7 Electrical diagram QA03-SDA-DIS-VAC-XXX-XXX

mA out from HMI
E1 (yellow) = HMI connector D14
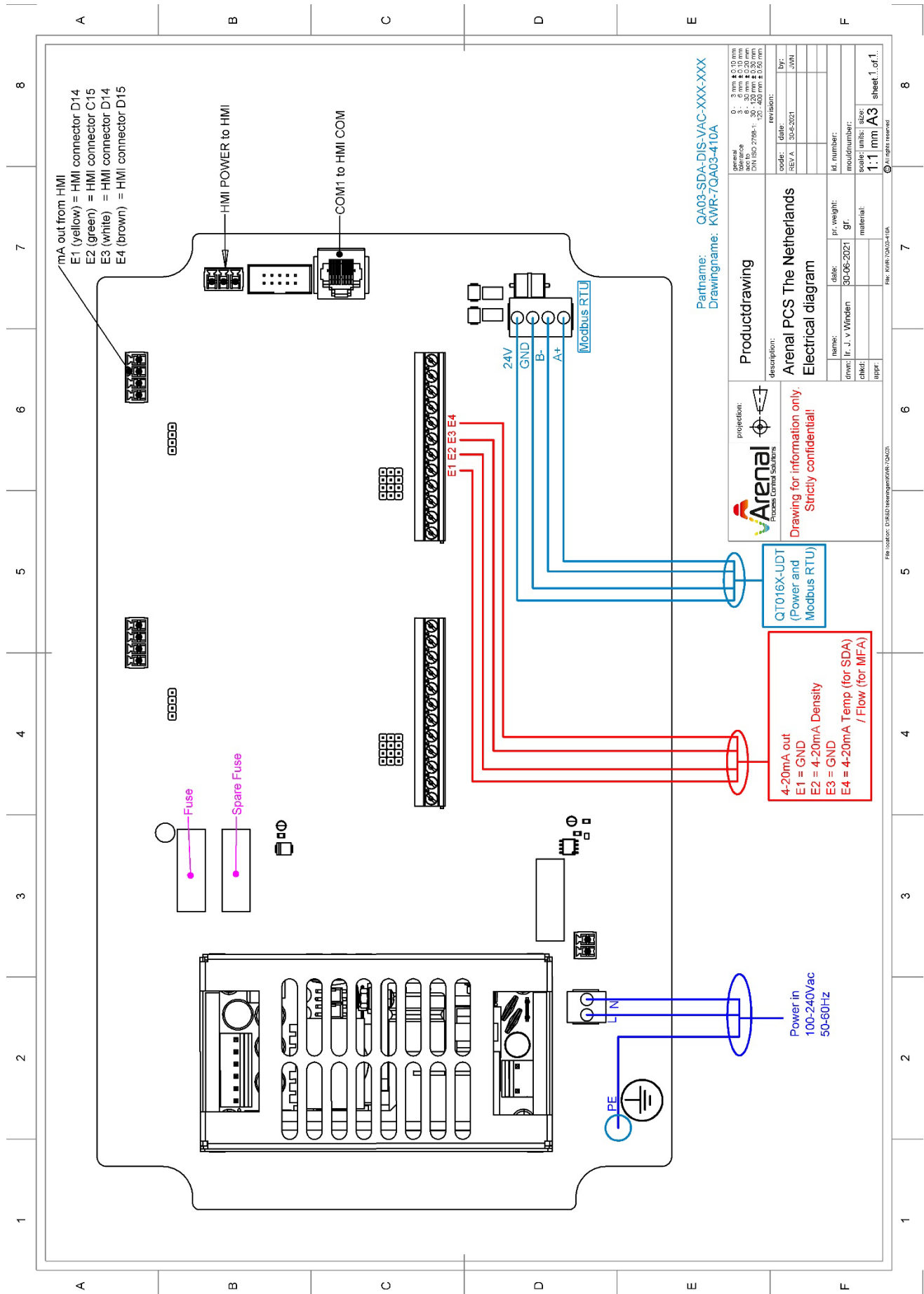E2 (green) = HMI connector C15
E3 (white) = HMI connector D14
E4 (brown) = HMI connector D15

HMI POWER to HMI

COM1 to HMI COM

Modbus RTU

24V
GND
B-
A+

E1 E2 E3 E4

QT016X-UDT
(Power and
Modbus RTU)

4-20mA out
E1 = GND
E2 = 4-20mA Density
E3 = GND
E4 = 4-20mA Temp (for SDA)
        / Flow (for MFA)

Fuse

Spare Fuse

Power in
100-240Vac
50-60Hz

PE

L N

Partname: QA03-SDA-DIS-VAC-XXX-XXX
Drawingname: KWR-7QA03-410A

Productdrawing

description:

Arenal PCS The Netherlands
Electrical diagram

projection:

Drawing for information only.
Strictly confidential!

general tolerance acc to DIN ISO 2768-1:		revision:		
0 - 3 mm ± 0.10 mm		code:	date:	by:
3 - 6 mm ± 0.10 mm		REV A	30-8-2021	JWN
6 - 30 mm ± 0.20 mm				
30 - 120 mm ± 0.30 mm				
120 - 400 mm ± 0.50 mm				

name:	date:	pr. weight:		id. number:
drwn: Ir. J. v Winden	30-06-2021	gr.		mould number:
chkd:		material:		scale: units: size:
appr:				1:1 mm A3 sheet 1 of 1

File location: D:\R&D tekeningen\KWR-7QA03\   File: KWR-7QA03-410A
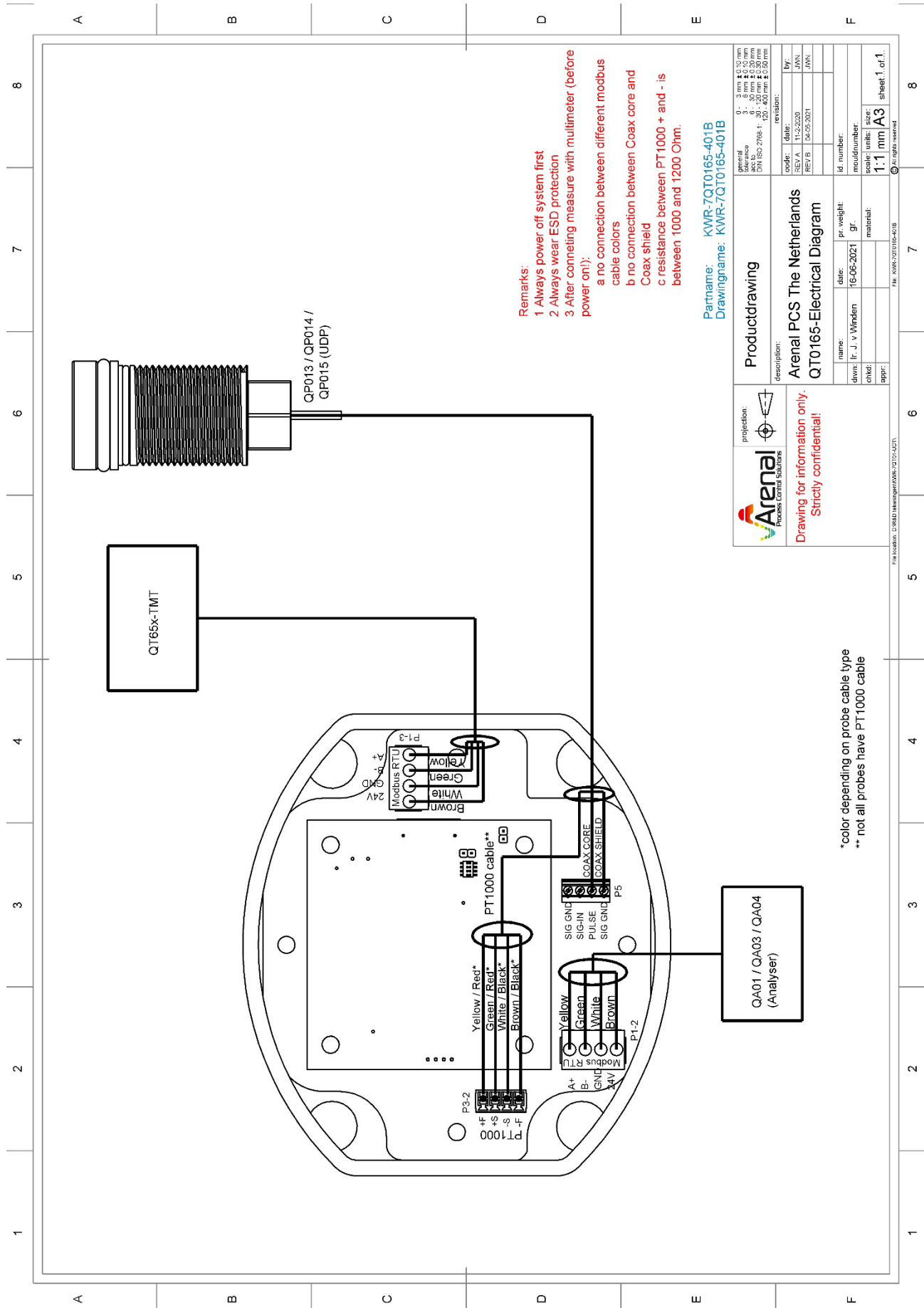
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A8 Electrical diagram QA03-SDA-GPX-VAC-XXX-IOM and QA03-SMA-GPT-XXX-IOM

A9 Electrical diagram QM102-MPC-HRT Remote Module

A10 Electrical diagram QT016(5) UDT (with QT65x TMT)

A11 Electrical diagram QT065x TMT