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Ultrasonic Flowmeters

ALTOSONIC V

KROHNE

Reference Guide



Operating manual Ultrasonic Flow Processor (UFP-V)



Applicable for software version 0300



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INTRODUCTION

This manual describes the operation of the ALTOSONIC-V ultrasonic flow-meter system and the handling of the data-files.

Also, in this manual you will find a description of the computer that is used, its data-acquisition and control cards, the software, possible errors and recommendations.

Note that in this manual all, standard and optional, specifications of the ALTOSONIC V are described

The manual is divided into two parts. Basic Operations and Extended Operations.

Product Liability and warranty

Responsibility for suitability and intented use of these ultrasonic flowmeters rests solely with the operator.

Improper installation and operation of the flowmeters (systems) may lead to loss of warranty.

In addition, the "General conditions of sale" forming the basis of the purchase contract are applicable.

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1 Basic and Extended operations

The first part of this manual will describe the Basic Operations. The second part of this manual (Chapter 10) will describe the Extended Operations.

Basic Operations:

- Start up
- Alarming
- Description of all windows
- Description of Standard volume to API2540
- Batching
- UFP Hardware description

Extended Operations:

- External Flowmeter setup (master duty)
- Base Sediment and water
- Other Standard Volume standards than API2540
- Extra batching functions
- Simulated Frequency on failure
- Meter factor adjustment through Modbus
- Reynolds Warning function

2 SYSTEM CONFIGURATION

2.1 Hardware configuration

The flow chart below includes all hardware specifications of the ALTOSONIC V regarding the flow measurement.



From this point on, in this manual the following abbreviations will be used

- UFS-V : Ultrasonic Flow Sensor (primary flow-meter body)
- UFC-V : Ultrasonic Flow Converter (5 converters)
- UFP-V : Ultrasonic Flow Processor

UFP-Program : Software program running on the UFP-V for measuring the flow.



2.2 UFP-Program

The operating system is DOS 6.22 for its proven reliability using real time data processing. The UFP-Program is controlled by initialisation data files and on-line configurable data files.

2.2.1 Initialisation data files

These files can be accessed by a DOS-editor when the UFP-Program is not running.

The Initialisation data files are divided into 3 groups:

UFS files : Calibration data regarding the Ultrasonic Flow Sensor (primary)

UFP files : Calibration and configuration data on the hardware set up within the UFP (cards etc)

DAT files : Client configuration data regarding the set up of communication and signal IO.

2.2.2 On-line configurable data files

These files are binary and only accessible when the UFP-program is on-line.API.bin: API settings on standard volume correctionDENSITOx.bin: 4 files for calibration data on densitometer cells Solartron 1 & 2, Sarasota 1 & 2OVERRIDE.bin: Override value settings

2.2.3 Functionality

The functionality can be divided into primary and secondary functions

Primary functions:

- Monitor data- and system integrity
- Data acquisition: data of five converters and optional data such as temperatures, pressures, densities, control bits, etc.
- Check the measured data from the five converters and handle errors, if necessary.
- Calculate the proces volumetric flow in the primary head from the measured data.
- Calculate the standard volumetric flow (e.g. 15 ℃, 1.01325 bar), if installed. Standard temperature can be set in the range 0-30 ℃.
- Totalise proces and standard flow as measured volumes
- Flow weighted averages on batching (temperature, pressure, density etc).
- Resetable and non resetable totalisers
- Output of calculated data and errors through: frequency output, analog outputs, digital outputs and Modbus communication.
- Possibility to override the input values (Temperatures, Pressures, Densities etc on line). Override is signalled as an alarm.
- Printing of tickets for batch functions such as Off Loading and Continuous Pipeline Measurement

Secondary functions:

- Statistics
- Back-up history such as totalisers, averages and alarms.
- Various screen functions for real-time monitoring.



Features

2.3

Data measured			
RS485	UFC-V ↔ UFP- Flow velocity Transit time Status UFC-V	-V (data communication connection between UFC-V and UFP-V): -five times (as a percentage) -five times -out of range, path failure, communication failure	
Analog in Temperature Pressure Density		: body, proces, densitometer* : proces*, densitometer* : proces*, standard*, densitometer*	
Digital in	igital in Start /Stop signals calibration (KROHNE used), or switch Densitometer calibration da Reset volumes and errors Reset errors		
Data processe Flow Sound velocity Resetable Tota Non resetable T API Density Analog in Temp Analog in Press Analog in Dens Flow weight ave	d for output to : proces : five ch ls : proces : pro	user s flow, standard flow*, mass flow* nannel values, mean value s volume, standard volume*, mass*. All forward, reverse, total. s volume, standard volume*, mass*. All forward, reverse, total. s, standard*, densitometer* proces*, densitometer* s*, densitometer* ometer*, standard* erature (body, proces*, Proving external*, standard*, densitometer*) ure (proces*, densitometer*) ty (proces*, standard*, densitometer*) tions (Ctl & Cpl values*) averages (= made in two time intervals*)]	
Batch ticket prir	nt : All out	put values can be printed by free definable layout configuration	
Data integrity Alarms on flow Alarms on syste Alarms on Low/	data em 'High Analog inp	uts*	

Data corrections under normal conditions

Reynolds correction Body expansion correction for temperature and pressure Standard volume correction according to API 2540* standard

Data corrections under alarm conditions

Real time profile correction on channel failure On-line override values on analog inputs* Filtering of measured data*

Service values on Modbus (measured by UFP but not used for calculation directly)

All temperatures, pressures, densities and Viscosity

* = Optional



Secondary input	Function
Temperature body	For correction of the expansion of the UFS, resulting in a correction
	factor K _b on the measured flow
Temperature proces*	For standard volume correction
	Resulting in a correction factor $C_{tl 15 to proces}$ on the measured flow
Temperature proces**	For correction on standard calibration volume (Factory use only).
	Function is only applicable when the calibration is not only monitored by
	the calibration facility but also, with a digital start/stop signal, by the
	UFP. The standard calibration volume is the volume measured at a
	standard temperature
Temperature densitometer*	For standard volume correction
	Resulting in a correction factor C _{tl 15 to densito} on the measured flow
Pressure proces*	For standard volume correction
	Resulting in a correction factor C _{pl proces} on the measured flow
Pressure densitometer*	For standard volume correction
	Resulting in a correction factor C _{pl densito} on the measured flow
Densitometer density*	The density measured by the densito meter
Density standard*	The density standard with at predefined standard temperature

* = Optional **= KROHNE Altometer calibration use only



3 UFP-V START UP

When the UFP is powered, the UFP-Program starts automatically.

To prevent unattended changes to the initialisation files the data is protected at start-up by:

- Calculation CRC checksum
- Check data from files on input range limits
- Password

3.1 Calculation CRC checksum

Each file has a CRC checksum. When anything changes in the file, the CRC-checksum will also change.

At the start-up of the UFP-V the CRC checksums are calculated and checked:

Start-up:

Г

flow0300.ufs: CRC correct	All data files have a ODO shashave
reyn0300.ufs: CRC correct	All data files have a CRC checksum
swr10300.ufs: CRC correct	
crc_date.ufs: GKG correct	CRC checksums are saved in file:
crc_norm.ufs: GKG correct	CRC NORM.ufs
heat0300 ufn: CBC comment	CRC_NORM.ufp
adea0300 ufn: CRC convect	CBC_NOBM dat
muca0300 ufn: CRC correct	ono_noninaa
defad_ufn: CRC correct	Deals up of all data files in:
defmp.ufp: CRC correct	Back-up of all data files in:
crc_date.ufp: CRC correct	CRC_FILE.uts
crc_norm.ufp: CRC correct	CRC_FILE.ufp
	CRC_FILE.dat
coms0300.dat: CRC correct	
syst0300.dat: CRC correct	CRC checksums and length of each file is saved in
cint0300.dat: CRC correct	CBC BACK ufs
tick0300.dat: CKC correct	
unit0200 dat: CPC compost	
eve nowe dat: CBC convect	
ere_norm.uac. one correct	(CRC checksums of these files are within the file)

If the checksum of a file is not identical to the one saved at the previous start-up in the CRC_NORM file, the program switches to fail mode.





CRC checksum error

If the fail mode is caused by a CRC-checksum error, there are three options:

- 1. Calculate a new CRC-checksum. The calculation is protected by password.
- 2. Load the backup file
- 3. Escape

CRC INCORRECT:make new retrieve escape,	CRCchecksumfile, backup datafiles,	hit k hit k hit k	key key key	(1) (2) (3)	<u>Causes:</u> 1 Change made in data file 2 sudden checksum error (not likely to happen)
YOUR CHOICE IS:					Possible actions: 1 new crc-checksum. 2 Load backup file: If crc checksum of backup files also fail, backup file not loaded. Check parameter file 3. Escape

Make new CRC checksum

lake new CRCfile, type password Enter current password	(=ma	ax 10 characters) **	1 Type the password On delivery the password is 7531 2 Enter
			When more than 30 characters are typed during input of the password the UFP-Program terminates and the UFP-Program must be restarted to make the new crc-file

To make a new CRC-checksum and to start the measure mode follow these steps:

- 1. MEAS [enter] (Batch file to start the measure mode)
- 2. 1357 (Pin code to stop the fail mode)
- 3. 1 (Choice to make a new CRC-checksum)
- 4. "Your password" (Pin code to make the new CRC checksum)
- 5. MEAS [enter] (Batch file to start the measure mode)

Note that the password can only be changed when the UFP-Program is running. To change it:

- Go to the Main Window
- Type code : PSSWRD
- Follow the directions in the window
- After the password is saved, the program automatically shuts down and a new CRC-checksum must be created. Start the UFP-Program and make the new CRC-checksum by using your new password.



3.2 Reading initialisation files on input range

Each parameter is checked for its input range.



- 1. If a parameter is out of range, the software switches to fail-mode. (Only breakable by pin code 1357)
- In fail mode a system set-up Error Code is given. The parameter and its input range are printed on screen. If the Modbus communication is active the set-up Error Code is also available on this output.
- If there are no problems at start-up, the software checks whether the CRC-checked data files correspond with the backup file BACK0300.bin.
 This backup file also has a CRC-checksum. Only when the data files do not correspond or the backup checksum gives an error, a new backup file and checksum are made.

3.3 Batch commands for configuration change and program start up

The following batch commands can be used in DOS mode:

No	Name	Description
1	MEAS	Start measure program to measure flow
2	AD	Start calibrate-verify AD card IO (AD-812)
3	FR	Start calibrate-verify Frequency card IO (MP103)
4	CLNT	Edit parameters on IO, Spans etc
5	COMS	Edit communication setup (Modbus, Batchprinter etc)
6	SYST	Edit the system file (syst0300.ufs)
7	TICK	Edit ticket (BOL) layout file
8	HSET	Edit parameters on hardware settings of the UFP
9	SECU	Secure all (configuration, programs, operating system)
10	BACKALL	Make a backup to an empty floppy of flow configuration and OS
11	BACKFLOW	Make a backup to an empty floppy of flow configuration only
12	BACKOS	Make a backup to an empty floppy of Operating System OS only
13	BACKZIP	Make a backup to empty floppy (zipped)
14	FLOW	Edit the flow calibration file
15	REYN	Edit the reynolds calibration file
16	SWRL	Edit the swirl calibration file

Note that these files are custody transfer configurations and a password is required to enable the changes for the measurement program.



3.4 Start up: system set-up errors

The system SET-UP ERRORS are caused by an improper initialisation such as data-change etc.

If the UFP-V identifies a system set-up error, it switches to fail-mode. The fail-mode shows the found error and the elapsed proces error time. The mode can only be stopped by pin code 1357.

Identified set-up errors are:

Error	Function	Problem	How to solve
1	CBC	Error opening: file(filename) to check on CBC	Try to load backup (CBC-function)
2	CBC	Error closing: file(filename) to check on CBC	Try to load backup (CRC-function)
3	CBC	Error opening: CBC-code file(filename)	Try to load backup (CRC-function)
4	CBC	Error closing: CBC-code file(filename)	Try to load backup (CRC-function)
5	CBC	Error length: CBC-code file(filename)	Make new CBC checksum
6	Common, opening file	Error in path: file(filename) not found	Try to load back-up (CRC-function)
7	Not in use	Not in use in this version	
8	Common. read in table	File(filename), maximum rows exceeded	Put in less data points
9	Common, closing file	Error read in file(filename)	Try to load backup (CRC-function)
10	Common, closing file	Error write in file(filename)	Try to load backup (CRC-function)
11	Read in profiles	Error in file(filename): a parameter < 0.01	Try to load backup (CRC-function)
12	Not in use	Not in use in this version	
13	Check on serial numbers	Serial numbers in parameter files do not correspond	Check the serial number in files
14	Initialising Graph driver	Graphics error	Is egavga.bgi file in directory ASV0300?
15	File location	Error in finding disk	Check the file locations in HSET0300.ufp
16	Frequency set-up	Error in set-up frequency output	Follow instructions on screen
17	Common, read in parameter	Error in a parameter file, bad up-dating, make sure that '#' is first	Check your last updated file or load backup (CRC function)
18	Common, read in parameter	Error in a parameter file, number too large (more then x characters)	Check your last updated file or load backup (CRC function)
19	Factory use only		
20	Factory use only		
21	Not in use		
22	Check location executable	Error in LOCATION_EXE, proces location is disk x	Change LOCATION_EXE in HSET0300.ufp
23	Not in use		
24	Check parameters on range	Out of range in file(filename), parameter(name)=x, Must be in range x1x2	Follow the instructions on screen
25	CRC-checksum outcome	CRC checksum not correct!	Make a new checksum or if not certain about the data, load the backup (CRC- function)
26	Not in use		
27	CRC-checksum	CRC backup-files checksum not correct	Fill in the correct data in actual files Backup
28	Batch status files	When the batch mode is enabled and the batch status files are not found at start-up.	After breaking the fail mode follow the instruction on screen to insert your last ticket number
29	Initialisation Printer	When the batch mode is enabled, the printer software is initialised. On error of initialisation	Check the COMS0300.dat file for errors in Printer set-up
30	Password	If for any reason the password is lost	Try to load backup (CRC-function)



The errors, which may occur during the initialisation of the Modbus Driver and the initialisation of the driver for the communication with the ultrasonic converters, are listed below.

• See for the communication system set-up errors also the ALTOSONIC V ModBus Manual.

Returned error numbers:

Error No.	Problem	How to solve		
1001	Modbus driver: Requested interrupt not supported	Make sure MODBUS_UART_INTERRUPT is within the limits (3 or 4)		
1002	Modbus driver: Requested baud rate is not	Make sure MODBUS_UART_BAUDRATE is within the limits		
	supported	(1200,2400,4800,9600,19200)		
1003	Modbus driver: Parity setting error	Make sure MODBUS_UART_PARITY is within the limits (0,1,2)		
1004	Modbus driver: Stop bit error	Make sure MODBUS_UART_N_STOPBITS is within the limits (1,2)		
1005	Modbus driver: RTS_MODE not supported	Make sure MODBUS_UART_RTS_MODE is within the limits (0 or 1)		
1006	Modbus driver: Number of bits not supported	Make sure MODBUS_UART_N_DATABITS is within the limits (7 or 8)		
1007	UFC driver: UART_init parameters error	Make sure Setting for the UFC communication are correct		
1008	Modbus driver: too many pollblocks installed	Make sure NUMBER_OF_POLLBLOCKS_TO_USE is not larger than 20		
1009	Modbus driver: function 6 only supports integer types in modicon compatible mode	When using the Modbus master mode in modicon compatible mode, function 6 only support integer types. When Other types (float, double) are necessary use function 16.		
1010	Modbus driver: Slave ID not in range of 0247	The Slave ID in a pollblock request must be between 1 and 247 or in case of a broadcast 0.		
1011	Modbus driver: Broadcast not allowed for this function (pollblock x)	Use a valid Slave ID to access only 1 slave.		
1012	Modbus driver: Function 5 and 6 can only handle 1 point (pollblock x)	When using function 5 or 6, make use the number of points is 1, these functions can handle only one point.		
1013	Modbus driver: Minimum number of points to request is 1 (pollblock x).	Make sure that at least 1 point is used for this action.		
1014	Modbus driver: data type not allowed (pollblock x)	The data type of the pollblock is not the same as the data type in the Modbus mapping		
1015	Modbus driver: unsupported data address, or request number of points out of range	The requested points must be in the available Modbus mapping.		
1016	Modbus driver: Data type / function mismatch	Make sure the Modbus function and the allowed data type do match		
1017	Modbus driver: Too many points requested	Make sure the Modbus message length is not exceeded, request fewer points.		
1018	General: unable to open the communication set- up file	Make sure the COMS0300.DAT file exists in this directory		
1019	General: unable to close the communication set- up file	Make sure the Drive is still powered.		
1020	General: error reading communication set-up file in parameter x	A parameter was expected but could not be read, make sure all the variables start with a #		
1021	General: error reading communication set-up file in parameter x, parameter out of range	A parameter was read, but not within the expected limits.		
1022	General: PC timer initialisation failed.	Try to restart the flow computer (cold start) else contact KROHNE		

3.5 System set-up warning

The system set-up warnings (SSW) are caused by:

- Insufficient statistical data during set-up (file REAL.BIN was not found)
 Default data is used until sufficient statistical information is recorded (under normal conditions within 3 minutes under normal flowing conditions). In this case the warning is self-resolving.
- Improper initialisation of the Modbus driver Modbus will not be accessible. In this case the warning remains active.



RUNTIME USER WINDOWS 4

In measure mode the screen is always divided into two parts.

- The Status Window at the bottom of the screen
- The Runtime User Window which is above the Status Window

Function keys control the Runtime User Windows. At the bottom of the Status Window the possible functions are showed for the particular Runtime User Window.

The status window:

Serial#:2325741001	Window :MAIN	Batch	: NON	KROHNE
Tag #:51-FT-002	Warnings:2	Printer	: CHECI	K Altometer
Version:03.00.50.01	Alarms :2	-task	: NON	(C) 2008
Data :exe00000-18421-43	067-63441	DUMMY	: NORM	IAL 09:04 👯
MAIN ALARMS CORRECT S	TATIST TREND	PROFILE BATCH	(CONTROLS SERVICE
F1 F2 F3	F4 F5	F6 F7	F8	F9 F10

It shows:

- Serial # : Serial number assigned by KROHNE Altometer
- : Tag number that can be defined by the user Tag #
- : Software version number Version •
- : CRC-checksum for the executable and of the 3 data sets (UFS, UFP, and DAT). • Data This can be a first check for the data integrity (every change in a data set changes the checksum of that data set). If the CRC-checksum of the executable (program) is 00000 as above the executable is either not certified or the data integrity is corrupted. Either way it is advised to load a new program executable. Details can be found under F10 Service, F9 CRC-Data .
- : The name of the Runtime window showing above Window
- Warnings : Number of actual warnings, details can be found in the Alarms window (F2)
- Alarms : Number of actual alarms, details can be found in the Alarms window (F2)

The following items are only shown if the batch mode is enabled in the initialisation file CLNT0300.dat

- : Batch status Batch
- : Printer status Printer
- : Print task Task

For more details on Batch mode see chapter 6.

On the bottom the F1...F10 keys represent the possible options available by using these function keys



4.1 Main menu: F1 Main window

The Main window is the default start-up window. This window shows an overview of the system and can always be accessed by function key F1.

UFC-DATA	flow [%]	v.o.s. [m/s]	CONDIT	IONS temper	ature pressu [°C] [bar	re density] [kg/m3]
Channe 1	5: 57.	2 0.0000	Proces	: :X	34.90 × 6.	10 631.90
Channe 1	4: 57.	4 1492.1	Standa	ind :	15.00 0.	00 650.00
Channe 1	3: 56.	7 1492.1	Densit	o ad-inp:	35.10 3.	60 725.30
Channe 1	2: 57.	7 1492.1	Body		35.30	
Channe 1	1: 56.	9 1492.1				
UFP-CALC	. 1929 2	6				
Proces	1787 1	9 [m3/n]				
Standard	1161 6					
	RESE	TABLE TOTAL	ISERS	NON I	RESETABLE TOTA	
GROSS	[m3]	[m3]	[t]	[m3]	[m3]	[t]
Forward	407.100	412.931	268.416	407.100	412.931	268.416
Reverse	0.000	0.000	0.000	0.000	0.000	0.000
Sum	407.100	412.931	268.416	407.100	412.931	268.416
Serial#:	2325741001	Win	dow :MAIN	Bat	teh : NON	KROHNE
Tag #:	51-FT-002 03 00 50 0	War 1 01-	nings: <mark>1</mark>	Pr:	inter:CHECK	Altometer
Data :	exe00000-1	8421-43067-	38203	DUI	1MY : NORMAL	09:30 💛
MAIN A	ALARMS COP	RECT STATI	ST TREND	PROFILE BATC	H CONT	ROLS SERVICE

Explanation of the Main window layout:

UFC-DATA shows:

- Raw data of the 5 channels regarding flow % and Velocity Of Sound (V.O.S.)
- A red marker (•) per channel shows an active channel failure, a green marker (•) shows a previously occurred channel failure

CONDITIONS show:

- Temperatures, pressures and densities measured or calculated for the conditions of Proces, Standard, Densitometer. Body temperature is also included.
- A red marker (X) in front of a parameter shows an alarm for out of range or manual on-line override, a green marker (X) shows a previously occurred alarm

UFP-CALC shows:

• Flow rates at Proces conditions, Standard conditions and Mass

RESETABLE TOTALISERS shows:

- The forward, reverse and summation of the Totaliser values at Proces conditions, Standard conditions and Mass.
- The resetable totalisers can be reset in the Control menu (through F9 in main): F8 RES-TOT. It is also possible to reset the totalisers by digital input signal or Modbus boolean.

NON RESETABLE TOTALISERS shows:

• The forward, reverse and summation of the Totaliser values at Proces conditions, Standard conditions and Mass.

CHANNEL ERRORS	
oor[s] path[s] dev.c[s] commu[s] comfa[s]	
Channel 5:	
Channel 4:	
Channel 3:= 34.15	
Channel 2:= 0.98	
Channel 1:= 33.87	
Torresture Redu . 0.00 0.00 00 encoded vision 424	3
Temperature Broose v 518 32 0.00	
Temperature Positive tenter: 0.00 0.00 1-4 channels down 19 352	87
Preserve Proces + 480.73 0.00 11 channels down - 15025	10
Pressure Prouing : 0.00 0.00	~
Pressure Depsitometer: 0.00 0.00 BEAL PROFILE [5]	
Pensity Pensitoad-inp: 0.00 0.00 Out of range :X 11.	27
Density Standard : 0.00 0.00	
Viscosity Kinematic : 0,00 0,00 CORRECTION WARNINGS [5]	
Correction on hold:X 6.	3Z
SYSTEM ERRORS OCCURRED Real-P on hold :x 14.	35
08	
NOTE that along are by durat	
1428 x Err 08 A:Measure Program CRC corrupt	on
Serial#:2325741001 Window :ALARMS Batch :NON KROHM	E
Tag #:51-FT-002 Warnings:2 Printer:OFF Altome	ter
Data :exe00000-18421-43067-38203 DUMMY : NORMAL 13:37	•••
MAIN ALARMS CORRECT STATIST TREND PROFILE BATCH CONTROLS SERV	ICE

4.2 Main menu: F2 Alarms window

Explanation of the Alarms window layout:

CHANNEL ERROR shows:

There are 5 types of errors

- 1. **OOR**, Out Of Range, flow data from the UFC is out of the limits 125...+125% flow rate. *Possible causes are:*
 - Flow out of range
 - Empty pipe
 - Problem with sensor
 - Problem with converter

Common check is: Value of the proces flowrate

2. PATH, Path failure. The transmitted signal from one sensor in the path is not correctly received by the other sensor in the path..

Possible causes are:

- Empty pipe
- Particles or solids in the fluid
- Cavitation due to low proces pressure resulting in gas bubbles
- Problem with converter
- Common checks are:
- Proces pressure
- Value of the proces flow rate
- 3. DEV.C, Deviation in sound velocity

The UFP calculates the mean sound velocity out of the three most nearby channel values (5 times) and then checks all channels on their deviation to this mean value



Deviation limit is set default to -0.5...+0.5 % of mean V.O.S. *Possible causes are:*

- Local density variations due to sludge, mixtures or temperature variations
- Empty pipe
- Problem with converter
- Problem with sensor
- Common checks are:
- Flow and sound velocity per channel
- 4. **COMMU**, Communication failure between UFP and UFC (rs485).

The communication is checked on communication errors. The incoming RS485 data is checked on validity. Single errors are skipped (COMFA's) but if there are more than 120 consecutive requests failing this alarm is raised.

Possible causes are:

- if all channels fail there is probably no power supply to the UFC
- if all channels fail it is probably caused by a malfunction of the connection between UFP and UFC
- if some channels fail the problem is in the specific converter of the UFC
- The specific converter is in it's configuration menu
- · The specific converter is not configured properly

Common checks are:

- Power supply UFC
- Converter displays
- If a new converter is installed, check the configuration
- Cable
- Connections
- Check the converter by exchanging the connections of a good converter for a probably bad converter. Note that the channel number is configured in the converter

5. **COMMFA**, single communication failures until COMMU is reached

Channel error types 1 to 4 are used to make the General Flow alarms. On General Flow alarm the REAL profile is used to correct the failing channels.

If COMFA's occur then the previous measurement on that channel is used for calculation.

Possible causes are:

- Multiple rapid window changes on slower CPU's
- EMC distortion through poorly connected wiring.

INPUT ALARMS shows:

Each parameter as stated below INPUT ALARMS has alarm settings in the CLNT0300.dat file. If the alarm is enabled and the parameter is used in the calculation then on alarm the time of occurrence is counted.

When the parameter is in manual override, the time of occurred manual override is counted.

CALCULATION shows:

When using the calculation for the standard volume by API standards the alarm is on if the density is out of range for the API group that is used (see chapter 5).

GENERAL FLOW shows:

The combined channel errors give an alarm on "1-4 channels" down and "all channels down" in time of occurrence.

If the UFP has a power failure then the time between start up and program running is calculated and added at start up of the UFP-Program.



REAL PROFILE:

On GENERAL FLOW error "1-4 channels down" the REAL profile is used to correct the channels with errors. The real profile is sampled at a certain flow rate.

- The REAL-profile correction has a limited validity. When the actual profile changes too much, the previously sampled REAL-profile might not be reliable anymore. The check for profile changes is done through flow-rate difference.
- When the sampled REAL-profile flow rate differs too much from the actual flow-rate during REALprofile correction this is shown as a warning.

CORRECTION WARNINGS shows:

- If there is too much flow variation for corrections, the corrections go on hold. When the corrections are on hold the real time profile is used as a standard for correcting the flow.
- If there are too much flow variations or channels failing, the sampling of the REAL profile goes on hold. On release the sampling is started at maximum time for sampling a profile.

SYSTEM ERRORS shows:

The status of the system is divided into:

- System Runtime Warnings. These are caused by system failures. These failures will not influence the flow measurement.
- System Runtime Alarms. These are caused by system failures. These failures might influence the flow measurement.

Identified System Runtime Errors are numbered 1 to 60 are:

4.2.1 SYSTEM ERRORS

-			
Error no.	In function	Problem	Consequence
A : 1	Get RS485 data from	Overrun, missed data	Missed data, message
	converters		
A : 2	Self test	Error in memory self-test	Non-reliable memory
A : 3	Batch start / stop	Error during saving files of start or stop	File lost but ticket is made
A : 4	Profile correction (REAL)	Error in state_correction	Attempt divide to by zero
W: 5	Read Backup all files	Error in reading backup file	Possible loss of backup file
W: 6	Switching disk	Error in finding a drive	Message
W: 7	System time	A notice that the system time was adjusted manually or by Modbus.	No consequence for totalisers or proces time, only on ticket time
A: 8	General program exectutable certification	CRC of the executable is not correct executable file is corrupted.	Load a new executable file. Contact KROHNE service for help
A: 9	Batch status backup	Status file corrupt	Possible loss of batch status
W: 10	Override values files	Error in opening/closing override value file	Override values not stored but still in use
A: 11	Batch totaliser backup	Totaliser backup-file corrupt	File lost, message
A: 12	Batch average backup	Average backup-file corrupt	File lost, message
A: 13	Batch ticket create	Error in creating batch ticket file	Ticket itself is made for printing
		-	but lost during saving
W: 14	Opening file (for update)	Error in opening REAL file	File lost, message
W: 15	Closing file (for update)	Error in closing REAL file	File lost, message
W: 16	API settings	Error in file, defaults are loaded and saved	Old settings lost
W: 17	Batch 2	A alarm on batch 2 file (Batch 2 is only	File lost, message
		used through Modbus with a Scada system)	
W: 18	Check free disk-space	Error dos_getdiskfree() call	Time-out function 30 s
W: 19	Check free disk-space	Low on disk-space	Time-out function 30 s
W: 20	Ad card overrun	The requested AD card is not noticed	Solve the problem
W: 21	Opening file (for update)	Error opening API table file	File lost, message
W: 22	Value check	1 or more API values defaulted	Check the installed parameters
W: 23	Opening file (for update)	Error opening external flow meter file	File lost, message
W: 24	Value check	Default external flow meter K-factor	Check the installed K-factor
W: 25	Counter input	Unable to read Counter value	Read on next entry
A : 26	Calibration MP103 card	MPCA File corrupt	Install backup

Identified System Runtime Errors are numbered 1 to 60, A = alarm, W = warning:



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A : 27	Calibration AD card	File corrupt	Install backup
A : 28	Calibration data Densito	File corrupt	Automatic install of default values
	Cells		Set the conect values on-line
A : 29	Batch ticket currently	A Requested batch ticket not available for	A ticket by that name was not
	saved	printing	saved or had a previous save
			error
A : 30	Batch ticket	CRC error in a Batch ticket	A ticket was not saved correctly
			or was changed manually
W: 31	Read batch ticket	A Requested batch ticket not available for	A ticket by that name was not
	previously saved	printing	saved or had a previous save
			error
W : 32	Batch ticket close file	Error in closing a ticket file	Ticket file not closed , probably
		-	because it could not be opened

See for the communication runtime errors also the ALTOSONIC V ModBus Manual.

Err no.	In function	Problem	Consequence
W: 33	Modbus master	Poll block not send due to transmit error	
W: 34	Modbus master	Poll block response time-out occurred	
W: 35	Modbus master	Invalid Slave ID in response	
W: 36	Modbus master	Invalid function in response	
W: 37	Modbus master	Response not correct	
W: 38	Modbus master	Error handling function 1,2	
W: 39	Modbus master	Error handling function 3,4	
W: 40	Modbus master	Error handling function 5	
W: 41	Modbus master	Error handling function 6	
W: 42	Modbus master	Error handling function 15	
W: 43	Modbus master	Error handling function 16	
W: 44	Modbus master	Exception received	
W: 45	Modbus master	Error unpacking Boolean data	
W: 46	Modbus master	Error unpacking integer data	
W: 47	Modbus master	Error unpacking long integer data	
W: 48	Modbus master	Error unpacking float data	
W: 49	Modbus master	Error unpacking double data	
W: 50	Modbus master/slave	Error incorrect message length	
W: 51	Modbus master/slave	Invalid CRC or LRC received	
W: 52	Modbus master/slave	Error receive buffer saturated	
W: 53	Modbus master/slave	UART error (parity, framing, overrun)	
W: 54	Modbus master/slave	Transmit buffer not empty for new transmission	
W: 55	Modbus slave	Unsupported function requested	
W: 56	Modbus slave	Unsupported register(s) requested	
W: 57	Modbus slave	Requested data Level and function mismatch	
W: 58	Modbus slave	Too many data point (registers) requested	
W: 59	Modbus slave	Error unpacking received data	
W: 60	Modbus slave	Broadcast not allowed	

Note: Occurred and disappeared alarms and warnings can be reset in the Control menu: F7 RES-ERR. It is also possible to reset by digital input signal or Modbus Boolean.



4.3 Main menu: F3 Corrections window

The Correction	is window monito	ors the corrections	6.		
Channel 5: Channel 4: Channel 3: Channel 2: Channel 1: v[m/s] :	BEAL-P 572.01 Real- 574.19 Flow. 567.30 577.10 568.97 7.78	p update[s]: corr. limit: 5	180 но. 393 %	D	
CORRECTION	roupolde	cuirl.		bodu-ovpape	ion
RE-velo : Visc[cSt]: AL : BL : RE-a&b : Visc-a&b : Kr HOLD:) Dev ab[%]:	0 0.00 1.859 # 1.313 338000 6.65 1.0010 6.85	Swirl [%]: Skewness [%]: Deviate-dA : Deviate-dB : Ks HOLD:	-0.789 0.481 0.000 0.000 1.0000	body-expans; Temp.body[°(Kb Kbp	21: 35.30 :▶ 1.0008 :▶ 1.0000
STANDARD VG CONDITIONS Proces Standard Densito ad	DLUME CORRECTI temperature [°C] * 34.90 : 15.00 -inp: 35.10	ONS pressure d [bar] [k × 6.10 (0.00 (3.60 ;	ensity g/m31 531.90 550.00 725.30	CORRECTION FACTOR To Std[°C] Ct1 Proces : 0.9708 Standard: 1.0000 Densito : 1.0000	ts Cp 1 1.0014 1.0000 1.0000
Serial#:232 Tag #:51- Version:03. Data :exe MAIN ALA F1 F	25741001 FT-002 00.50.01 00000-18421-43 RMS CORRECT S 2 F3	Window : COR Warnings:2 Alarms :3 3067-63187 TATIST TREND F4 F5	PROFILE	Batch : NON Printer: OFF Ltask : NON DUMMY : NORMAL BATCH CON F7 F8	KROHNE Altomete (C) 200 14:02 TROLS SERVIC F9 F10

Explanation of the Corrections window layout:

REAL-P shows:

- The previously sampled profile.
- The remaining update time to make the new REAL profile.
- The sampling goes on hold if:
 - Channel errors occur
 - Less than 5% flow rate
 - This will show in yellow colour as HOLD.
- The validity range in flow rate percentage of the sampled REAL profile. Out of this range an alarm condition is activated

CORRECTION REYNOLDS:

There are three methods in using the Reynolds correction (method 1 is normally used).

- 1. Through ratio measured numbers AL and BL the profile belonging to a certain Reynolds Number and its correction factor Kr is recognized in a calibrated lookup table. This the default used method
- The kynematic viscosity is measured and the Reynolds number is calculated from F(Viscosity, Diameter, Velocity). By a calibrated Reynolds table the correction factor Kr is found. Note that Viscosity needs to be measured by the UFP or inputted by Modbus communication for this method.
- 3. Input the Viscosity under reference conditions and the UFP corrects the viscosity for temperature proces condition. Possible to have up to 6 liquids with choice by measured sound velocity. This method is normally not used.

See the configuration file Reyn0300.ufs for further details.



In the picture method 1 is in light-blue meaning this method is used to make the Reynolds correction factor Kr.

In the picture method 2 and 3 is in grey meaning this method is not used to make the Reynolds correction factor Kr.

The green arrow ► at the Kr location shows that this Kr factor is used in the flow calculation. No arrow means: Not used.

When the correction is on hold due to flow variations this is shown in yellow as HOLD at the Kr location. During the hold period the corrections are done with the REAL-profile as a reference.

The "Dev AB %" shows the percentage of deviation between measured AL BL pair and closest interpolated match to AL BL the lookup table. The smaller the deviation the higher the quality of the Reynolds Correction normally is.

SWIRL shows:

In version 03005000 and later the previous used Swirl Number is replaced by the Swirl% and Skewness%.as quality parameters on the measured flow profile.

The Swirl % is an indication for the found swirl. A normal value is -3.5%...+3.5%.

Out of this range the swirl is considered to have a influence on the flow measurement accuracy. The Skewness % an indication for the skewness of the measured flow profile. As Skewness can come in many different shapes (symmetrical, and assymetrical) it is difficult to put a limit on the allowed percentage. Skewness is installation specific and can come in many different shapes (symmetrical and asymmetrical). Determination of a limit should be based on installation experience. Registration of skewness during start up or during the first few weeks of installation will give insight in the installation specific limits

It is strongly recommended to avoid swirl by using a flowstraighting device. In the situation whereby flow straigtners can not be used or are insufficient for the high levels of swirl can not be elimimated the A-V has option to use a swirl correction factor because swirl influences the profile and as such the used correction based A and B needs to be compensated for this the swirl correction table can be used. This correction value if possible should be avoided. Hoewever if swirl is present the result will be much better neverthelees the accuracy of the A-V will be lowered and as such the A-V may operate outside its spec.

By default the swirl correction factor is not used.

Only if there is physically no way to correct a swirl it is used to make a more reasonable flow value but this value is inaccurate. As such the ALTOSONIC V may operate outside its specification to be within specs of the ALTOSONIC V because of possible uncalibrated swirl intensities and viscosities.

- The green arrow > at the Ks location shows that the factor is used in the flow calculation.
 No arrow means: Not used in the flow calculation.
- If the correction is on hold due to flow variations, this is shown in yellow as HOLD at the Ks location. During the hold period the corrections are performed with the REAL-profile as a reference.

BODY EXPANSION shows:

The **temperature expansion correction** is done with the measured Body(Primary) temperature. The correction factor is Kb. The green arrow ► at the Kb location shows that the factor is used in the flow calculation. No arrow means: Not used.

The correction for body thermal expansion is as follows:

$$K_b = 1 + 3 \cdot \alpha \cdot (T_{body} - T_{ref})$$

- K_b : Correction factor used for the body thermal expansion
- α : Lineair thermal correction factor [°C⁻¹], depending on the type of metal material.
- T_{body} : Temperature body [°C]
- T_{ref} : Temperature reference [°C]

The Kb factor is implement as a normal kfactor to correct the measured volume for thermal body expansion.

Another option to use (by default disabled) is the **pressure expansion correction**. Only applicable for high process pressures. The correction factor is Kbp. The green arrow \triangleright at the Kbp location shows



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that the factor is used in the flow calculation. The correction is lineair and depends on meter construction.

For example correction per 100 Bar difference for:

- a certain ALTOSONIC V 6 inch construction is about +0.04%
- a certain ALTOSONIC V 10 inch construction is about +0.045%

As this is a linear function the correction at 50 Bar difference would be half the value (0.02%). This was calculated using the standard: ISO/CD 17089/1

The correction is described in different standards. To be compliant with these different standards KROHNE as made the choice to put the correction in a general formula:

$$K_{pb} = 1 + \frac{C_{pb}}{100} \cdot (P_{proces} - P_{ref})$$

 K_{bb} : Correction factor used for the pressure expansion

 C_{bp} : Lineair pressure correction factor [%/bar], depending on the construction and used standard.

P_{proces} : Pressure proces[bar]

P_{ref} : Pressure reference [bar],

Note that P expansion correction is disabled at that time, or used pressure is low.

STANDARD VOLUME CORRECTIONS shows:

- The temperatures, pressures and densities at proces, standard, densitometer and optional external flow meter conditions in relation to the correction factors Ctl and Cpl
- The correction factors Ctl (temperature correction to 15 °C) and Cpl (pressure correction to 1.01325 bar, or 0 barg)

See chapter 5 for more information on the Standard Volume correction



4.4 Main menu: F4 Statistics window

The Statistics window shows the statistics and monitors the flow variations for the corrections and REAL-profile sampling.

TIME CONSTANTS			
Tmeas[s] : 0.00			
$\tau_{corr[s]}$: 40.00			
τ real[s] : 60.00	Undate in Is	:] : 4	
	-F		
Average	Stand.dev.		
[؉.]	[%]		
Channel 5: 572.67	4.40		
Channel 4: 584.67	2.97		
Channel 3: 611.35	2.43		
Channel 2: 584.44	2.86		
Channel 1: 568.83	4.36		
Velo : 8.08	1.38		
DEVIATION 1	r::τ∕10		
Correction	REAL-P		
Switch : 20.0	20.0		
Channel 5: 0.6	0.0		
Channel 4: 0.2	0.0		
Channel 3: 0.1	0.0		
Channel 2: 0.4	0.0		
Channel 1: 0.6	0.0		
Velo : 0.2	0.0		
	HOLD 2s		
Serial#:2325741001	Window :ST	ATISTICS Batch	: NON KROHNE
Tag #:51-FT-002	Warnings:1	Printer	CHECK Altometer
Data :exe00000-1842	1-43067-63187	DUMMY	: NORMAL 15:07 V
MAIN ALARMS CORRE	CT STATIST TREND	PROFILE BATCH	

Explanation of the Statistics window layout:

TIME CONSTANTS:

- Tmeas gives the time-constant in seconds as used for the incoming 5 measuring paths flow percentages. Default the time-constant is 0 sec.
- Tcorr gives the time-constant in seconds as used for the Reynolds and Swirl corrections. Default the time-constant is 40 sec.
- Treal gives the time-constant that is used for sampling the REAL-profile. Default the time-constant is 60 sec. After 3 times Treal (180 seconds) the sampled REAL profile is used for possible correction.

STATISTICS:

- The average and relative standard deviation of the 5 channels and the calculated velocity is calculated over 200 (default) measurements (about 7 seconds).
 So every 7 seconds there is an update on these standard deviation values.
- The average for the channels is presented as flow-rate promillage (-1250...+1250), especially practical to measure the zero point deviation per channel at zero flow rate. Note that there will be temperature differences in the proces liquid causing local flows at zero flow.
- Normal is that channels 1 and 5 have a larger standard deviation then channels 2, 3 and 4. For ALTOSONIC V 's without straightener the shown readings for the standard deviation are normal. With a flow straightener build-in these values can be reduced by approximately a factor 2.

DEVIATION:

The flow variations for the corrections and REAL-profile are monitored as described below:

• All channels and calculated velocity are monitored with the normally used time-constant and with the normal time-constant divided by 10. If the difference between those two time-constants is more



than the switch value (default 20%) for one of the channels or the velocity the corrections go on hold. When everything is normal again, they are released again and used in the normal way.

4.5 Main menu: F5 Trend-flow window

The Trend-flow window shows the Raw UFC flow percentage as a trend over 10 seconds. This makes flow variations per channel visible in a graphic.



Each channel has is own colour.

Function keys do the controls of this window, therefore it is only possible to go back to the Main window.

- F1 : Back to Main window
- F2 : To default normal Y scale (0...120%)
- F3 : To zero flow Y scale (-0.5 ... +0.5%)
- F4 : To change low value Y scale, control by F9 and F10
- F5 : To change high value Y scale, control by F9 and F10
- F6 : To change points of average (default over 4 measurements), control by F9 and F10
- F7 : To change step [%] for UP and DOWN scaling
- F8 : To rule out channels, to get a better view over the remaining channels, type <C1>,<C2>,<C3>,<C4>,<C5> to enable and disable channels
- F9 : Up scaling for function F4, F5, F6, F7
- F10 : Down scaling for function F4, F5, F6, F7

Note that there is no influence on the normal flow measurements.



4.6 Main Menu: F6 Profile window

The Profile window shows the profile of the flow that in the measuring section of the flowmeter and is therefore a good graphical display of the measured profile. Swirl or bend profiles can be easily detected by this graph.



F6 : To change points of average (default over 4 measurements), control by F9 and F10

F9 : Up scaling for function F6

F10 : Down scaling for function F6, F7

A typical low Reynolds number profile is shown above. The blue surface is the noise band on the flow measurement.

Note that anything that is done in this window by using function keys causes <u>no interference with the</u> <u>normal flow measurements</u>.

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For example a symmetrical swirl profile would look like this:



For this example in relation to normal: ch5 larger, ch1 smaller, ch4 smaller, ch2 larger, and ch3 close to normal.

The above profile would lead to about 20% Swirl and would have a large influence on the flow measurement.



4.7 Main Menu: F7 Batch window

This window is only visible when batch mode is enabled in de initialisation file CLNT0300.dat. Below is only the window as showed when no batch is running. For more details on batch mode see chapter 6 BATCH MODE.

BATCH The I Start Conf: API s Curre Batch	CONTROL W patch option t stop batch irmation as settings dur ent ticket n n Volume Ern Volume Ern	INDOW is conf permiss ced on AP ring batc number ror [%]	igured as ion I/strings h	s follou s : ;	At all Yes No 0.04	flow con 62	ditions		
F1	Back to i	is baten Main wind	is runnii Iow	ng					
F2 F8	: Read/prin : End Batel	nt a prev n and wri	ious bate	ch ticket	t				
Serial Tag Versio Data	#:232574100 #:51-FT-002 n:03.00.50 :exe000000)1 2 .01 -18421-43	Window Warnings Alarms 067-63187	:BATCH 5:1 :3 7	CONTROL	Batch Printer Ltask DUMMY	: RUNNING : CHECK : NON : <mark>NORMAL</mark>		KROHNE Altometer (C) 2008 15:40 ♥
MAIN F1	READ F2	F3	F4	F5	F6	F7	END F8	F9	F10

New since software version 03.00.50.01 is the option to view, during the batch, the worst case batch Volume Error % estimate due to batch alarms such as path failures, input signals alarms etc etc



4.8 Main menu: F9 Controls window

This is the start window for the controls where a description is given of the types of controls possible.

CONTROL MODE
Note that using this mode is influencing flow measurements or calculations
F1 MAIN : Back to Main Window F2 API : Controls the settings for Standard Volume/Mass by API standards
F3 EXTERN : Controls the settings for the external flowmeter (if connected)
F5 DENSITO: Controls the Densito meter calibration data
F6 TIME : Show/set time F7 PES_EPP: Paset the ecourted errors (alarms warnings)
F8 RES-TOT: Reset the resetable totalisers and ocurred errors
F9 STD. : Choose (API/ASTM-IP/LPG/ULHC) correction standard
F10 Quit : Stop the measure mode and go to DOS
Serial#:2325741001 Window :CONTROLS Batch :RUNNING KROHNE Tag #:51-FT-002 Warnings:2 Printer:0FF Altometer Version:03.00.50.01 Alarms :3 Ltask NON (C) 2008 Data :exe00000-18421-43067-63187 DUMMY NORMAL 07:55 V
MAIN API EXTERN MANUAL DENSITO TIME RES-ERR RES-TOT STD. QUIT F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

IMPORTANT:

- Using this mode (CONTROLS) is influencing flow measurements or calculations (except for function F6).
- When Batch mode is enabled it is possible that certain controls are not accessible due to the batch mode configuration. See chapter 5 BATCH MODE for more details.



4.8.1 Controls menu: F2 API settings window

In this window the configuration can be made for calculating the standard volume /mass. The green arrows ► represent the current settings per option. The red arrow ► is the option cursor.

API STANDARD VOLUME/	MASS CONFIGURA	TION DATA						
Calculation : DISABLED STANDARD VOLUME/MASS BY API STANDARDS MASS MEASUREMENT BY PROCES DENSITY								
Temperature standard	: • 15.000 t ·	·C1						
Density standard by	: FILL IN MA Calculated On AD/Mode	NUALLY FROM DENSITOME US INPUT	TER DENSITY					
Fluid type	CRUDE GASOLINE TRANS.AREA JET GROUP FUEL OIL FREE FILL	API2540 Tempera -18 -18 -18	Table 54C to ture[°C] 150 125 95 curre	emperature limits Alpha*1e-6 486 918 918 954 954 1674 ent: 1453.2				
Density standard	: > 650.00 CH	(g/m3]						
КО К1 К2	: 613.972 : 0.00000 : 0.00000	Change mode at <enter> <arrow down;<br="" up=""><arrow left="" rig<br=""><i n="" p=""> <1,2,3; </i></arrow></arrow></enter>	always : Set par : Scroll/ ght>: Increas : normal, : Save co	am./value-change Change value e step value °API 60, SG nfiguration				
Serial#:2325741001 Tag #:51-FT-002 Version:03.00.50.01 Data :exe00000-1842	Window Warnings Alarms 21-43067-63187	: API-SETTINGS : 2 : 3	Batch : NOP Printer:CHP Ltask : NOP DUMMY : NO	N <mark>KROHNE</mark> ECK Altometer N (C) 2008 <mark>RMAL</mark> 07:59 ♥				
MAIN ENTER UP F1 F2 F3	DOWN F4	LEFT RIGHT F5 F6	INP1 INP2 F7 F8	2 INP3 SAVE F9 F10				

CALCULATION option is configurable:

- 1. *Disable*, no standard volume or mass is calculated
- 2. Standard volume/mass by API standards
- 3. Mass measurement by input of proces density.

TEMPERATURE STANDARD:

When the CALCULATION option is 2, the used temperature standard is selectable between 0-30 °C or equivalent in °F. If the temperature standard is changed, the input limits for the density standard per fluid type also change to default and have to be configured as desired.

DENSITY STANDARD BY:

When the CALCULATION option is 2 then the method to establish the density standard is configurable:

- 1. *Fill in manually* value for the density standard manually in this window. Additional only proces temperature and pressure must be measured.
- 2. Calculated from Densitometer density. The density standard is calculated by iteration of the measured density (on frequency or AD input). Additional proces and densitometer temperatures and pressures must be measured.
- 3. *On AD input.* Density standard on an AD input. Additional only proces temperature and pressure must be measured and the temperature standard must be set according to input density standard.

FLUID TYPE:

When the CALCULATION option is 2 then the used fluid type is configurable. Each fluid type has its own density standard limits.



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DENSITY STANDARD:

When the CALCULATION option is 2 and the DENSITY STANDARD BY is fill in manually, the density standard value is selectable within the limits of the chosen FLUID TYPE.

Note that there are different options for how to input the density, i.e. as mass/volume, °API60 or SG (Configurable by Function key F7, F8, F9)

<u>K0, K1, K2:</u>

When the CALCULATION option is 2 and the FLUID TYPE is Freefill then the correction factors K0, K1 and K2 can be configured.

API2540 table 54C temperature limits:

The correction according to API2540 table 54C is valid within temperature and calculated Alpha limits as shown in above window.

The reading "current" is the calculated Alpha. If the Alpha or a used temperature is out of limits then the API correction is out of limits and the alarm API GROUP MISMATCH is raised.

Description of the controls in this window:

Function keys do the controls of this window, therefore it is only possible to go back to the Main window. For practical use also normal keys have the same functionality.

F1	: Go back to Main window
F2 (or <enter>)</enter>	: Set a parameter or disable/enable value change
F3 (or <arrow up="">)</arrow>	: Scroll up with red cursor. Or if value change is enabled(F2) increase value
F4 (or <arrow down="">)</arrow>	: Scroll down with red cursor. Or if value change is enabled (F2), decrease value
F5 (or <arrow left="">)</arrow>	: If value change is enabled(F2) increase step value of change(F3,F4)
F6 (or <arrow right="">)</arrow>	: If value change is enabled(F2) decrease step value of change(F3,F4)
F7 (or <inp1>)</inp1>	: Normal density standard manually input
F8 (or <inp2>)</inp2>	: Density standard manually input as °API 60
F9 (or <inp3>)</inp3>	: Density standard manually input as SG
F10(or <s>)</s>	: Save configuration

Note:

Make sure you save the data after the changes are made as desired. It is also possible to make the configuration by Modbus communication

Additional information about the used API standards etc can be found in: chapter 4 CALCULATION OF STANDARD VOLUME AND MASS

4.8.2 Controls menu: F3 External-flow meter window

External Flow meter is described in the Extended Operations section of this manual



4.8.3 Controls menu: F4 Manual override window

In this window a manual override can be made on several input parameters.

MANUALLY OV	ERRIDE VALUES	IN	PUT					
			м	anually		Measured		
Temperature	Body	:		0.00	•	35.30	[°C]	
Temperature	Proces	: 1	•	34.90		100.70	[°C]	Default: 🕨 32.00
Temperature	Proving	1		0.00		0.00	[°C]	
Temperature	Densitometer	÷		0.00		35.10	[°C]	
Pressure	Proces			6.10		8.20	[bar]	
Pressure	Proving	1		0.00		0.00	[bar]	
Pressure	Densitometer	:		0.00		3.60	[bar]	
Density	Densitometer	:		0.00		725.30	Ekg/m3	1
Density	Standard			0.00		0.00	[kg/m3	1
Viscosity	Kinematic	:		0.01		0.00	[eSt]	
NOTE that manual override for a input can only be set(); 1. If input alarms are enabled in the setup 2. If input is used in calculations (except viscosity)								
				KEnt KAri KAri KS E KB>	ier Iow Iow E T	-> up/down uleft/rig >	} ght≻	Set param./value-change Scroll/Change value Increase step value Set Manual or Measured Save configuration
Serial#:2325	741001	Wir	ndo	w :MAN	1 0	VERRIDE	Bate	h : NON KROHNE
Tag #:51-F	T-002	War	rni	ngs:2			Prin	ter:OFF Altomete
Data :exe0	0000-18421 <u>-43</u>	ні.)67 <u>-</u>	-0 <u>1</u> :	s : 3 275			DUMM	Y : NORMAL 08:10
MAIN ENTE	R UP	DOM	IN	LEFT		RIGHT	SET	SAVE

Note that a manual override for an input:

- Can only be set if the input alarms are enabled in the initialisation
- Can only be set if the input is used in calculations (except for the viscosity)
- Sets the alarm for the parameter that is in manual override, but the alarm time is counted separately. See Alarms window

The green arrows ► represent the current settings per parameter. No green arrow ► means that it is not possible to set that parameter because of the above restrictions.

- The red arrow is the scrollable cursor position
- Manually : The override value is set manually, this always causes an alarm condition
- Measured : Value as measured on AD/Modbus/Frequency input
- Default : The default override value on first occurrence of active alarm.

The default override value on first occurrence active can be configured in the initialisation file CLNT0300.dat section 9.

Example Temperature proces parameter:

TEMPERATURE PROCES		
9.8 MODE	=#1	//Use input:0=disable, 1=AD-input, 2=Modbus
9.9 MODBUS_SERVICE	=#0	//Service input:0=disable, 1=AD-input
9.10 Alarm_out	=#1	//disable=0, enable=1 alarm to output
9.11 alarmLow	=#0	//Low alarm below this value [øC]
9.12 alarmHigh	=#100	//High alarm above this value [øC]
9.13 Override	=#20	//Default static override value [øC] on alarm
9.14 Override_code	=#2	//0=disable override value, 1=use default override
		<pre>//2=use default batch average as override</pre>



The OVERRIDE_CODE (9.14) makes it possible on first occurrence of active alarm to have:

- (0) No override value, measurement value is used for calculations
- (1) Use the default static override value OVERRIDE (9.13).
- (2) Use the batch average value of the parameter as calculated up to first occurrence of active alarm

Description of the controls in this window:

The red arrow ► is the scrollable cursor position

Function keys do the controls of this window, therefore it is only possible to go back to the Main window.

F1	: Go back to Main window
F2 (or <enter>)</enter>	: Set a parameter or disable/enable value change
F3 (or <arrow up="">)</arrow>	: Scroll up with red cursor >. Or if value change is enabled (F2) increase value
F4 (or <arrow down="">)</arrow>	: Scroll down with red cursor >. Or if value change is enabled (F2), decrease value
F5 (or <arrow left="">)</arrow>	: If value change is enabled (F2) increase step value of change (F3, F4)
F6 (or <arrow right="">)</arrow>	: If value change is enabled (F2) decrease step value of change (F3,F4)
F7 (or <set>)</set>	: Set as manual override or measured input
F10 (or)	: Save configuration



4.8.4 Controls menu: F5 Density cell window

When a density cell is used to measure the density for Standard Volume calculation then the hardware configuration must be made in the initialisation files HSET0300.ufp and CLNT0300.dat. The calibration data for that particular cell can be set in the window below.



Description of the controls in this window:

Function keys do the controls of this window, therefore it is only possible to go back to the Main window.

F1 : Go back to Main window F2 (or <ENTER>) : Set a parameter or disable/enable value change F3 (or <arrow up>) : Scroll up with red cursor. Or if value change is enabled (F2) increase value F4 (or <arrow down>) : Scroll down with red cursor. Or if value change is enabled (F2), decrease value F5 (or <arrow left>) : If value change is enabled (F2) increase step value of change (F3, F4) F6 (or <arrow right>) : If value change is enabled (F2) decrease step value of change(F3, F4) F7 (or $\langle EXP \rangle$) : Increase the exponential value, when value change is enabled (F2) F8 (or <EXP->): Decrease the exponential value, when value change is enabled (F2) F9 (or <CELL>) : Scroll the data set, possible to scroll between: SOLARTRON 1 SOLARTRON 2 SARASOTA 1 SARASOTA 2 F10(or < B>): Save configuration



4.8.5 Controls menu: F6 Time window

The system time can be set in this window.

SHOW/SET SYSTEM TIME			
yyyy-nn-dd Systen tine: 2008-09-05	hh:nn:ss 08:23:07		
Set time:	08:23:07		
Servie 14, 2005741001	IL-J., ITTMP OPT		
Tag #:51-FT-002 Version:03.00.50.01 Data :exe00000-18421-430	Warnings:2 Warnings:2 Alarms :3 067-01275	Printer:CHECK Ltask :NON DUMMY : NORMAL	Altometer (C) 2008 08:23 V
MAIN UP F1 F2 F3	DOWN LEFT RIGHT F4 F5 F6	F7 F8	F9 F10

Note:

- The system time is not the time used for making the totalisers. The time used by the totalisers is the proces time. This time is calibrated together with the frequency output because the frequency output uses the same processor timer in the UFP.
- The Set Time can have a maximum deviation to System Time of ± 2 hours in one saving.
- For very large deviation settings it is better to do the setting under DOS by commands TIME and DATE.
- It is also possible to set the time through Modbus controls.

Description of the controls in this window:

Function keys do the controls of this window, therefore it is only possible to go back to the Main window.

F1: Go back to Main windowF3: Scroll up in value at the red cursor position valueF4: Scroll down in value at the read cursor positionF5: Change cursor position to the leftF6: Change cursor position to the rightF10: Save configuration (set the desired time)


The manua	I reset of	f all alarms a	nd warning	s.					
RESET EF	RORS								
F2 :T0	ENABLE	BESET							
	LINDLL	THE O'L'							
Serial#: Tag #:	2325741 51-FT-0	1001 102	Window Warning	:RESET s: <mark>2</mark>	ERRORS	Batch Print <u>e</u> r	: NON : OFF	KR0 Alto	HNE
Version: Data :	03.00.5 exe0000	50.01)0-18421 <u>-4</u> ;	Alarms 3067-01 <u>27</u> 5	:3 5		^L task DUMMY	: NON : NORMAL	(C) 08:25	2008
MAIN F1	RESET F2	CONFIRM F3	F4	F5	F6	F7	F8	F9	F10

4.8.6 Controls menu: F7 Reset Errors window

Reset sequence:

- Enable the reset by function key F2
- Confirm to reset by function key F3

It is also possible to reset by digital input signal or Modbus boolean.



4.8.7 Controls menu: F8 Reset Totalisers window

The manual reset of the resetable totalisers and all alarms and warnings.

RESET TOTALISERS A	ND ERRORS						
F2 :TO ENABLE RES	ET						
Serial#:2325741001 Tag #:51-FT-002 Version:03.00.50.01 Data :exe00000-18	Windo Warni L Alarm 3421-43067-01	w :RESET ngs:2 s :3 275	TOTALS	Batch Printer Ltask DUMMY	NON CHECK NON NORMAL	<u>KRO</u> Altor (C) 08:26	HNE meter 2008 5 💛
MAIN RESET CON F1 F2 F	FIRM 3 F4	F5	F6	F7	F8	F9	F10

Reset sequence:

- Enable the reset by function key F2
- Confirm to reset by function key F3

It is also possible to reset by digital input signal or Modbus boolean.

4.8.8 Controls menu: F9 Standard Volume choice in used standard

This window entry can be blocked in the configuration file CLNT0300.DAT, for custody transfer regulations that can differ by country/region This window is described in the Extended Operations section of this manual.



4.8.9 Controls menu: F10 Quit measure mode window

Window to terminate the measure mode and go to DOS mode.

MEASURE MODE WILL STOP AFT	ER CONFIRM!!!!!!		
TO STOP MEASURE MODE P TO CONTINUE MEASURE MODE P	RESS F5 RESS F1		
Serial#:2325741001 Tag #:51-FT-002 Version:03.00.50.01 / Data :exe00000-18421-4306 MAIN	Window :QUIT SYSTEM Warnings: 2 Alarms : 3 67-01275 CONFIRM	Batch : NON Printer: CHECK Ltask : NON DUMMY : <mark>NORMAL</mark>	<u>KROHNE</u> Altometer (C) 2008 08:28 ♥

Quit sequence:

• Confirm to quit function key F5

To proceed use function key F1

IMPORTANT: If the UFP-Program is stopped. No flow measurements/calculations are performed anymore.



4.9 Main menu: F10 Service window

This is the start window for the Service windows where a description is given of the types of Service windows there are.

SERV	ICE MODE	1
Note	that us	ing this mode is of no influence on flow measurements
or e	alculati	ons
F1	MAIN	: Back to Main Window
F2	INT	: Shows occurred system interrupts
FЗ	UFC-E	: Shows UFC actual error report
F4	UFC-D	: Shows UFC incoming data by RS485
F5	MOD-E	: Shows MODBUS occurred error report
F6	MOD-S	: Shows MODBUS status report
F7	MOD-D	: Shows MODBUS data fields
F8	PARA	: Shows parameter files
F9	CRC-DAT	A: Shows CRC-checksums of data files
F10	10	: Shows All AD/DA IO signals
Seria	a1#:2325' #:51_E	741001 Window :SERVICE Batch :NON KROHNE
Versi	ion:03.0	0.50.01 Alarms : 3
Data	:exeO	0000-18421-43067-01275 DUMMY : NORMAL 08:37 V
MAIN	I INT	UFC-E UFC-D MOD-E MOD-S MOD-D PARA CRC-DATA IO

Note that using this mode (SERVICE) is of no influence on flow measurements or calculations

These Service windows are especially practical for debugging errors when an ALTOSONIC V system is set-up for Modbus and I/O signals (AD/DA).



4.9.1 Service menu: F2 Interrupts window

Under normal circumstances it is not necessary to view this window.

```
SERVICE WINDOW: Interrupt activity
MASTER ICU.
                1879
     Irq 0 :
                       (Timer 0)
     Irq 1 :
                  4
                      (Keyboard)
                      (Slave 8259)
     Irq 2 :
                  0
               2179
     Irq 3
                      (COM2/4)
    Irq 4
Irq 5
               5139
                      (COM1/3)
                      (LPT1)
    Irq 6
Irq 7
                   0
                      (Diskette controller)
                   0
                      (LPT1)
SLAVE ICU, redirected to IRQ2
     Irq 8 :
                   0 (CMOS clock)
     Irq 9 :
                   0 (Reserved)
     Irq 10 :
                 0 (Reserved)
     Irq 11 :
                 0 (Reserved)
     Irq 12 :
                 0 (Pointing dev.)
     Irq 13 :
                  Θ
                      (Math co.pr. exception)
                      (Fixed disk)
     Irq 14 :
                  21
     Irg 15 :
                   0 (Reserved)
Serial#:2325741001
                              Window : INTERRUPTS
                                                         Batch
                                                                               KROHNE
Tag #:51-FT-002 Warnings
Version:03.00.50.01 Alarms
Data :exe00000-18421-43067-01275
                                                                              Altometer
(C) 2008
08:38 V
                 UFC-E
F3
 MAIN
                            UFC-D
F4
                                    MOD-E
F5
                                              MOD-S
                                                       MOD-D
                                                                 PABA
                                                                        CRC-DATA
          INT
F2
                                                                                     10
F10
```

The Interrupt window is the lowest level PC activity monitor.

The serviced interrupts are counted per source. Therefore, the activity on for example a COM port for Modbus can easily be monitored for any signals coming in.

The settings for the communication can be found in parameter file COMS0300.dat

- Default settings for the COM ports are:
- Irq 3: COM 4, Modbus for RS422/RS485.
- Irq 4: COM 3, RS 485 UFC DATA communication.

If the Modbus communication is set up on the RS485 card there must be activity on COM 4. (Or Modbus communication on a RS232 port then use port 2).

If there is no activity then check the configuration in the COMS0300.dat and check the connections and wiring.

4.9.2 Service menu: F3 UFC errors window

Under normal circumstances it is not necessary to view this window.

SERVICE WINDOW:	UFC erro	r report									
Requests 1	1159	Chan:	1	2	3	4	5				
paritu error			0	0	0	0	0				
Err message leng	rth		120	120	120	120	120				
wrong startbytes	s Rx		120	120	120	120	120				
framing err uart	t		Θ	0	0	0	0				
Channelstate			2	2	2	2	2				
olddata			0	0	0	0	0				
overrun int 8, r	newdata		0	0							
Serial#:23257410	001	Window	: UF	C-ERR	ORS	Ba	tch	: NON		KRO	HNE
Tag #:51-FT-00)2	Warnin	gs:2			Pr Lt	inter	· CHEC	ĸ	Altor	neter 2008
Data :exe00000)-18421 <u>-4</u> ;	3067-0 <u>12</u>	75					: NOR	1AL	08:44	⊧ <u> </u>
MAIN INT	UFC-E	UFC-D	MOD-E	E MO	2-dc	MOD	-D	PABA	CRC-	DATA	10

All data shown here is also available in more common used windows in perhaps other formats or condensed into less variables.

The status is shown as counters per channel.

There is no history in the counters so previous occurred errors will turn to zero.

Communication *errors* per communication message (=per channel request):

- Parity errors
- Error in message length
- Wrong start bytes
- Framing error UART

Communication status sublimated from communication errors per channel:

- Channel state = 0: no errors (status normally)
- Channel state = 1: error resulting in a single communication failure (COMFA)
- Channel state = 2: comm. failures in succession resulting in a communication alarm (COMMU)

Communication status regarding data skipped or already handled:

- Old data : Counter for data, already handled(Note: normally toggles between 0 and 1).
- Overrun : Counter for data, skipped because of system time shortage (note: cumulative!).



4.9.3 Service menu: F4 UFC data

	Jnder norn	nal circi	umstances	it is not ne	ecessary t	o view thi	s windo	w.			
	SERVICE	WINDOW	: UFC da	ta							
	Channe l	Tra	nsit Time	[ms]	Flow[%]	L	ine	DA	IA		
	5		0.000000	1	0.00	In	active	newdata	a		
	4		0.000000)	0.00	Ind	active	newdata			
	3		0.000000)	0.00	Ind	active	newdata	a		
	2		0.000000	1	0.00	In	active	newdata	 1		
	1		0.000000)	0.00	Ind	active	newdata	 1		
	-		0.00000		0.00			11044444			
	Serial#:	232574	1001	Windo	w :UFC-	-DATA	Ba	teh :M	ION	KRO	HNE
	Tag #:	51-FT-	002	Warni	ings:2		Pr	inter:(HECK	Altor	neter
	Data _:	03.00. exe000	30 .01 00-18421-	43067-01	ns : 2 1275		DU	ask :M MMY :	NORMAL	08:46	2008
ĺ	MAIN	INT	UFC-E	UFC-D	MOD-E	MOD-S	MOD-	D PA	BA CB	-DATA	10
ĺ	F1	F2	F3	F4	F5	F6	F7	F	8	F9	F10

Under normal circumstances it is not necessary to view this window.

All data shown here is also available in more common used windows in perhaps other formats. This window shows the raw basic flow data from the UFC-V with no history capacity.

Data of all channels:

- Transit time as [ms]
- Flow rate as percentage [-125...+125%]
- Line status (normally active, on communication failure Inactive)
- Data status (New data, old data (previously handled), old data time out (on communication alarm))



4.9.4 Service menu: F5 Modbus errors window

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the occurred Modbus communication errors. The various errors are shown as historical counters per communication error.

Under normal circumstances it is not necessary to view this window.

SERVICE WINDOW: Error report (slave mode)	
Error_invalid CRC/LRC received Error modbus rx buffer saturated	: 0 : 0
Error uart error parity/framing/overrun	: 0
Error transmitbuffer not empty	: 0
Error_unsupported_function	: 0
Error_unsupported_data_address	: 0
Error_datatype(field)_function_mismatch	: 0
Error_too_many_datapoints_requested	: 0
Error_unpack_data	: 0
Error broadcast not allowed	: 0
Serial#:2325741001 Window :MOD-ERRORS Tag #:51-FT-002 Warnings:2 Version:03.00.50.01 Alarms :2	Batch : NON <u>KROHNE</u> Printer:CHECK Altometer Ltask : NON (C) 2008
Data :exe00000-18421-43067-01275	DUMMY : NORMAL 08:48 ¥
MAININTUFC-EUFC-DMOD-EMOD-SF1F2F3F4F5F6	MOD-D PARA CRC-DATA IO F7 F8 F9 F10

When every counter is zero but the Modbus communication seems to fail first monitor the Interrupt window for any activity on the Comport.

All data shown here is also available in more common used windows in perhaps other formats or sublimated into less variables.



=1

4.9.5 Service menu: F6 Modbus STATUS

When setting up the UFP-V Modbus driver for communication this window is very useful for showing addressed functions and responses.

SERVICE WINDOW: Modbus action report (slave mode))		
	21160	(SUCCESEUI	1)
Complete response received (incl valid CRC/LCR):	OLLTO U	(000010101	<u></u> ,
Normal response transmitted	õ		
Exception response transmitted :	õ		
Function 01:	Õ	(0)	
Function 02:	0	(0)	
Function 03:	0	(0)	
Function 04:	Θ	(0)	
Function 05:	0	(0)	
Function 06:	0	(0)	
Function 08:	0	(0)	
Function 15:	0	(0)	
Function 16:	0	(0)	
MODBUS_STATUS = 0			
MODBUS_LAST_ERROR = 0			
Serial#:2325741001 Window :MOD-STATUS	Batch	: NON	KROHNE
Tag #:51-FT-002 Warnings:2	Printer Ltack	· NON	Altometer
Data : exe00000-18421-43067-01275	DUMMY	: NORMAL	08:50 💙
MAININTUFC-EUFC-DMOD-EMOD-SF1F2F3F4F5F6	MOD-D F7	PARA CRC- F8 F	DATA IO 9 F10

Function 1	: Read coil
Function 2	: Read input status
Function 3	: Read multiple holding registers
Function 4	: Read input registers
Function 5	: Write single coil
Function 6	: Write single holding register
Function 8	: Diagnostics
Function 15	: Write multiple coil
Function 16	: Write multiple holding register



4.9.6 Service menu: F7 Modbus data window

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

·									
SERVICE MODE 2: Modbus DATA fields									
Note that using this mode is of no influence on flow measurements									
or calculations									
F1 MAIN : Back to Main Window									
F2 SERV1 : Back to Service mode 1									
F3 MOD-D1 : Shows MODBUS data fields, BOOLEAN(r;r/w)									
F4 MOD-D2 : Shows MODBUS data fields, INTEGER(r) 1100									
F5 MOD-D3 : Shows MODBUS data fields, LONG(r) 1100									
F6 MOD-D4 : Shows MODBUS data fields, FLOAT(r) 1138									
F7 MOD-D5 : Shows MODBUS data fields, FLOAT(r) 139250									
F8 MOD-D6 : Shows MODBUS data fields, DOUBLE(r) 1033									
F9 MOD-D7 : Shows MODBUS data fields, FLOAT(r/ψ) 1138									
F10 MOD-D8 : Shows MODBUS data fields, STRING(r/w)									
Serial#:2325741001 Window :MOD-DATA Batch :NON KROHNE									
Tag #:51-FT-002 Warnings:2 Printer:CHECK Altometer									
Deta : exe00000-18421-43067-01275 DUMMY NORMAL 08:51									
MAIN SERVI MOD-D1 MOD-D2 MOD-D3 MOD-D4 MOD-D5 MOD-D5 MOD-D7 MOD-D2									
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10									



4.9.6.1 Service menu 2: F3 Modbus data1 window Booleans R/W

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

Under normal	circumstances it is not necessary to view this wind	ow

BOOLEAN (0100	0):1128						
1	9	17	25	33	41	49	57
i .	ι.		i .	ι.		ι.	ι.
001:00000000	00010100	10110000	00000000	00000000	00000000	00001000	00000000
065:00000001	10010000	00100000	00000000	00000000	00000000	00000000	00000000
BOOLEAN (02000	0):1320						
1	9	17	25	33	41	49	57
i .	ι.	ι.	÷ .	ι.	ι.	i .	i .
001:00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
065:00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
129:00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
193:00000000	00000000	00000000	00000000	00000000	00000000	00000000	01000000
257.10000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
231.10000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
Serial#:23253	741001	Windo	w :MOD-D	ATA1	Batch : 1	NON	KBOHNE
Tag #:51-F1	r-002	Warni	ngs:2			CHECK	Altometer
Version:03.00	0.50.01	Alarm	s : 2		Ltask :1	101	(C) 2008
Data :exeO(0000-1842:	1-43067-01	275		DUMMY :	NORMAL	08:53 💛
MAIN SERUI F1 F2	L MOD-D1 F3	L MOD-D2	MOD-D3 M	10D-D4 MOI F6	F7 MOD-	-D6 MOD-D7	7 MOD-D8 F10

4.9.6.2 Service menu 2: F4 Modbus data2 window Integers (R)

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

INTEGER (0)	3000):110	90					
01=000154	02=014921	03=003200	04=000610	05=012693	06=003530	07=000150	
08=000098	09=000119	10=000121	11=000119	12=000120	13=000120	14=014921	
15=014921	16=014921	17=014921	18=014921	19=000000	20=000002	21=000000	
22=000003	23=000000	24=000000	25=000000	26=000008	27=000000	28=000000	1
29=000000	30=000000	31=000002	32=000002	33=000001	34=000058	35=000008	
36=000005	37=000009	38=002008	39=000000	40=000000	41=000000	42=000195	
43=000000	44=000000	45=000000	46=000000	47=000000	48=000000	49=000000	1
50=000000	51=000000	52=000000	53=000000	54=000000	55=000000	56=000000	1
57=000000	58=000000	59=000000	60=000000	61=000000	62=000000	63=000000	1
64=000000	65=000000	66=000000	67=000000	68=000000	69=000000	70=000000	
71=000000	72=000000	73=000000	74=000000	75=000000	76=000000	77=000000	
78=000000	79=000000	80=000000	81=000000	82=000000	83=000000	84=000000	1
85=000000	86=000000	87=000000	88=000000	89=000000	90=000000	91=000000	1
92=000000	93=000000	94=000000	95=000000	96=000000	97=000000	98=000000	1
99=000000	100=00000	0					
Serial#:2	325741001	Wind	dow :MOD-	DATA2	Batch ! N		
Tag #:5:	1-FT-002	Warı	nings:2		Printer: 0	DFF .	Altomete
Version:0	3.00.50.01	Ala	rms :2		Ltask :N	ION	(C) 200
Data :ex	×eUUUU0-184	121-43067-0	J1275		DUMMY :	NURMAL	08:58
MAIN SE	HUI MOD-	DI MOD-D2	: MUD-D3	MUD-D4 MO	ID-DS MOD-	De MOD-D.	7 MOD-D





4.9.6.3 Service menu 2: F5 Modbus data3 window LongInt (R)

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

Under normal circumstances it is not necessary to view this window

LUNGINT(05000	J:1100	02-000044024	04-0004(((000	00-00000400	
01=0001709155	02=0000000154	03=0000014921	04=0001666693	05=0000000150	
06=0001149504	07=0000000098	08=000000002	09=0001709155	10=0000000000	
11=0001666693	12=0000000000	13=0001149504	14=0000000000	15=2147483647	
16=0003005001	17=0000000000	18=000000008	19=0000000000	20=0000000000	
21=0000000000	22=0000000000	23=0000000000	24=0000087307	25=0000027370	
26=0000027370	27=0000000000	28=0000026830	29=0000026830	30=0000000000	
31=0000018101	32=0000018101	33=0000000000	34=0000000000	35=0000000000	
36=0000000000	37=0000000000	38=0000000000	39=0000000000	40=0000000000	
41=0000000000	42=0000000000	43=0000000000	44=0000000000	45=0000000000	
46=0000000000	47=0000000000	48=0000000000	49=0000000000	50=0000000000	
51=0000000000	52=0000000000	53=0000000000	54=0000000000	55=0000000000	
56=0000000000	57=0000000000	58=0000000000	59=0000000000	60=0000000000	
61=0000000000	62=0000000000	63=0000000000	64=0000000000	65=0000000000	
66=0000000000	67=0000000000	68=0000000000	69=0000000000	70=0000000000	
71=0000000000	72=0000000000	73=0000000000	74=0000000000	75=0000000000	
76=0000000000	77=0000000000	78=0000000000	79=0000000000	80=000000000	
81=0000000000	82=0000000000	83=0000000000	84=0000000000	85=0000000000	
86=0000000000	87=0000000000	88=0000000000	89=0000000000	90=0000000000	
91=0000000000	92=0000000000	93=0000000000	94=0000018421	95=0000043067	
96=0000001275	97=0000000000	98=0000000000	99=0000232574	100=000000100	1
S	41001 11		TA3 D-1-L	L NON	KDOLINE
Tag #:51-FT	-002 W	arnings:2	Print	er:CHECK	<u>KRUHNE</u> Altomet
Version:03.00				: NON	(C) 20
Data :exeOO	000-18421-4306	7-01275	DUMMY	: NORMAL	08:59
MAIN SERU1 F1 F2	MOD-D1 MOD- F3 F	-D2 MOD-D3 MC 4 F5	ID-D4 MOD-D5 F6 F7	MOD-D6 MOD-D7 F8 F9	' MOD-E F:

4.9.6.4 Service menu 2: F6 Modbus data4 window Float (R 1..138)

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

FLOAT(07000)	:1138				
001=14.69225	002=1492.100	003=32.00000	004=06.10000	005=0634.663	006=35.30000
007=14.34557	008=09.32462	009=04.55172	010=04.61679	011=04.53840	012=04.59351
013=04.57610	014=1492.100	015=1492.100	016=1492.100	017=1492.100	018=1492.100
019=14.94198	020=00.00000	021=00.00000	022=00.00000	023=00.00000	024=00.00000
025=00.00000	026=00.00000	027=01.00000	028=01.00000	029=00.00000	030=01.00000
031=01.00076	032=0650.000	033=00.00000	034=00.00000	035=00.00000	036=00.00000
037=00.00000	038=22.46545	039=04.55172	040=04.61679	041=04.53840	042=04.59351
043=04.57610	044=00.00000	045=35.10000	046=03.60000	047=00.00000	048=00.00000
049=00.00000	050=00.00000	051=00.00000	052=00.00000	053=00.00000	054=00.00000
055=00.00000	056=00.00000	057=00.00000	058=00.00000	059=00.00000	060=00.00000
061=00.00000	062=00.00000	063=00.00000	064=00.00000	065=00.00000	066=00.00000
067=0725.300	068=2500.000	069=00.97512	070=01.00131	071=01.00000	072=01.00000
073=01.00000	074=01.00000	075=01.00000	076=01.00000	077=35.30000	078=34.90000
079=00.00000	080=35.10000	081=06.10000	082=00.00000	083=03.60000	084=0725.300
085=0689.660	086=00.00000	087=00.97413	088=01.00105	089=01.00000	090=01.00000
091=01.00000	092=01.00000	093=01.00000	094=01.00000	095=15.00000	096=0672.557
097=1838.368	098=00.00000	099=00.00000	100=01.00000	101=00.00000	102=00.00000
103=00.00000	104=1775.000	105=00.00000	106=1070.748	107=00.00000	108=00.00000
109=00.00000	110=00.00000	111=00.00000	112=00.00000	113=00.00000	114=00.00000
115=00.00000	116=00.00000	117=00.00000	118=00.00000	119=4785.142	120=00.00000
121=00.00000	122=4785.177	123=00.00000	124=00.00000	125=00.00000	126=00.00000
127=00.00000	128=30.87428	129=30.54346	130=00.00000	131=30.69029	132=05.69353
133=00.00000	134=03.31189	135=0667.253	136=0674.546	137=00.00000	138=00.97916
Serial#:23257	741001	Window : MOD	-DATA4 B	atch : NON	KROHNE
lag #:51-F1 Version:03.00	002	Warnings:2 Alarms :2		rinter:OFF task :NON	Altometer (C) 2008
Data :exeO	0000-18421-430	067-01275		UMMY : NORMA	09:01 🗸
MAIN SERUI	MOD-D1 MO	D-D2 MOD-D3	MOD-D4 MOD-	D5 MOD-D6 M	OD-D7 MOD-D8





4.9.6.5 Service menu 2: F7 Modbus data5 window Float (R 1..138)

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register. Under normal circumstances it is not necessary to view this window

FLOAT(07000)	:139250				
139=01.00108	140=01.00000	141=01.00000	142=01.00000	143=01.00000	144=01.00000
145=01.00000	146=15.00000	147=0661.090	148=1832.310	149=00.00000	150=00.00000
151=01.00000	152=00.00000	153=00.00000	154=0738.910	155=022777.0	156=0424.534
157=2173.340	158=11.26772	159=00.00000	160=00.00000	161=00.00000	162=00.00000
163=00.00000	164=00.00000	165=00.00000	166=00.00000	167=00.00000	168=00.00000
169=00.00000	170=6303.578	171=00.00000	172=00.00000	173=6265.404	174=00.00000
175=00.00000	176=00.00000	177=00.00000	178=00.00000	179=00.00000	180=00.00000
181=00.00000	182=00.00000	183=00.00000	184=00.00000	185=00.00000	186=00.00000
187=00.00000	188=00.00000	189=00.00000	190=00.00000	191=00.00000	192=00.00000
193=00.00000	194=00.00000	195=00.00000	196=00.00000	197=00.00000	198=00.00000
199=00.00000	200=00.00000	201=00.00000	202=00.00000	203=00.00000	204=00.00000
205=00.00000	206=00.00000	207=00.00000	208=00.00000	209=00.00000	210=00.00000
211=00.00000	212=00.00000	213=00.00000	214=00.00000	215=00.00000	216=00.00000
217=00.00000	218=00.00000	219=00.00000	220=00.00000	221=00.00000	222=00.00000
223=00.00000	224=00.00000	225=00.00000	226=00.00000	227=00.00000	228=00.00000
229=00.00000	230=00.00000	231=00.00000	232=00.00000	233=00.00000	234=00.00000
235=00.00000	236=00.00000	237=00.00000	238=00.00000	239=00.00000	240=00.00000
241=00.00000	242=00.00000	243=00.00000	244=00.00000	245=00.00000	246=00.00000
247=00.00000	248=00.00000	249=00.00000	250=00.00000		
Serial#:23257	41001	Window :MOD	-DATAS B	atch : NON	KROHNE
Tag #:51-FT		Warnings:2		rinter: CHECK	Altometer
Data :exeOC)000-18421-430)67-01275		UMMY : NORMA	<u>(</u> 09:04 ♥
MAIN SERUI	MOD-D1 MC	D-D2 MOD-D3	MOD-D4 MOD-	D5 MOD-D6 M	IOD-D7 MOD-D8
F1 F2	F3	F4 F5	F6 F	-7 F8	F9 F10

4.9.6.6 Service menu 2: F8 Modbus data6 window Double (R)

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

MAIN SER	1 MOD-D1	MOD-D2 MOD-	-D3 MOD-D4	MOD-D5 MOD-	D6 MOD-D7 MO	DD-D8
Data :exe	00.00.01 00000-18421-4	нтагмз : 43067-01275		DUMMY :	NORMAL 13:3:	2008
Tag #:51-	FT-002	Warnings:	2	Printer:0	FF Alto	meter
Serial#:232	5741001	Window :	MOD-DATA6	Batch :M	ION KRO	DHNE
31=00.00000	32=00.00000	33=00.00000	20-00.00000	2.3-00.00000	30-00.00000	
19=Z736.990 25=1810 133	20=00.00000	21=2683.044	22=2683.044	23=00.00000	24=1810.133	
13=01149504	14=00.00000	15=00.00000	16=00.00000	17=00.00000	18=2736.990	
07=09.32462	08=00.00000	09=01709155	10=00.00000	11=01666693	12=00.00000	
01=01709155	02=14.69225	03=1492.100	04=01666693	05=14.34557	06=01149504	
DOUBLECOGOO	0):1.33					



4.9.6.7 Service menu 2: F9 Modbus data6 window Float (R 139..250)

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

Under normal circumstances it is not necessary to view this window

	.4 420				
FLUHI(07500)	:1138	000-00 00000	AA4-AA AAAAA		000-0000-000
001=00.00000	002=01.00000	003=00.00000	004=00.00000	005=0650.000	006=0700.000
007=0780.000	008=0800.000	009=0900.000	010=0750.000	011=00.00000	012=00.00000
013=00.00000	014=15.00000	015=00.00000	016=0900.000	017=0550.000	018=00.00100
019=00.10000	020=00.00000	021=00.00000	022=01.00000	023=00.00000	024=01.00000
025=01.00000	026=00.00000	027=00.00000	028=00.00000	029=00.00000	030=00.00000
031=00.00000	032=-1184.62	033=-00.3141	034=00.00133	035=-00.0000	036=00.00610
037=00.00006	038=-00.0000	039=00.08014	040=-00.0017	041=00.00000	042=-1184.62
043=-00.3141	044=00.00133	045=-00.0000	046=00.00610	047=00.00006	048=-00.0000
049=00.08014	050=-00.0017	051=00.00000	052=01.10754	053=1385.135	054=1812.597
055=-00.2934	056=-00.0076	057=20.00000	058=01.01325	059=00.00000	060=01.10754
061=1385.135	062=1812.597	063=-00.2934	064=-00.0076	065=20.00000	066=01.01325
067=00.00000	068=00.00000	069=00.00000	070=00.00000	071=00.00000	072=00.00000
073=00.00000	074=00.00000	075=00.00000	076=00.00000	077=00.00000	078=00.00000
079=00.00000	080=34.90000	081=00.00000	082=00.00000	083=06.10000	084=00.00000
085=00.00000	086=00.00000	087=00.00000	088=00.01000	089=00.00000	090=-0099999
091=00.00000	092=00.00000	093=00.00000	094=00.00000	095=00.00000	096=00.00000
097=00.00000	098=00.00000	099=00.00000	100=00.00000	101=00.00000	102=00.00000
103=00.00000	104=00.00000	105=00.00000	106=00.00000	107=00.00000	108=00.00000
109=00.00000	110=00.00000	111=00.00000	112=00.00000	113=00.00000	114=00.00000
115=00.00000	116=00.00000	117=00.00000	118=00.00000	119=00.00000	120=00.00000
121=00.00000	122=00.00000	123=00.00000	124=00.00000	125=00.00000	126=00.00000
127=00.00000	128=00.00000	129=00.00000	130=00.00000	131=00.00000	132=00.00000
133=00.00000	134=00.00000	135=00.00000	136=00.00000	137=00.00000	138=00.00000
S	741001		DATA7 D		
Serial#:2325	(41001 [-002	Window : MUD Warnings: 2	-рынд В	atcn :NUN rinter:OFF	Altometer
Version:03.00	0.50.01	Alarms :2		task : NON	(C) 2008
Data :exeO	0000-18421-430	067-01275	D	UMMY : NORMA	L 13:33 Y
MAIN SERUI	MOD-D1 MC	D-D2 MOD-D3	MOD-D4 MOD-	D5 MOD-D6 M	IOD-D7 MOD-D8

4.9.6.8 Service menu 2: F10 Modbus data6 window ASCII 8 char (R), 16 char (R/W)

When setting up the UFP-V Modbus driver for communication this window is very useful for showing the available Modbus data fields in address and value for verifying data on both host side and UFP side per data register.

ASCII[8](04000):14 01=' 02='	` 03= '	` 04='	
ASCII[16](14000):16 01=' 04='	02=' 05=' 2325	`03= 741001`06=	, 51-FT-002`
Serial#:2325741001 Tag #:51-FT-002 Version:03.00.50.01 Data :exe00000-18421-43	Window :MOD-D Warnings:2 Alarms :2 3067-01275	DATA8 Batch Print Ltask DUMMY	:NON <u>KROHNE</u> er:OFF Altomete :NON (C) 200 :NORMAL 13:34
MAIN SERV1 MOD-D1 M	IOD-D2 MOD-D3 M	MOD-D4 MOD-D5	MOD-D6 MOD-D7 MOD-D8



4.9.7 Service menu: F8 Parameter window

It is possible to view the Initialisation files on line while measuring. For safety not the actual files are viewed but the backup file, so parameter files themselves are safe.

VIEW CONTENTS OF FI	LE BY TYPING FILE	NUMBER (2 digits):	
01 flow0300.ufs		Ŭ	
02 reyn0300.ufs			
03 swr10300.ufs			
04 crc date.ufs			
05 hset0300.ufp			
06 adca0300.ufp			
07 mpca0300.ufp			
08 defad.ufp			
09 defmp.ufp			
10 crc_date.ufp			
11 coms0300.dat			
12 syst0300.dat			
13 cInt0300.dat			
14 tick0300.dat			
15 crc_date.dat			
Serial#:2325741001	Window : PARA	-FILES Batch	: NON KROHNE
Tag #:51-FT-002	Warnings:2	Printer	CHECK Altometer
Data : exe00000-18421	Alarms :3 -43067-01275	-task DIMMY	: NORMAL 14:22
MAIN INT UEC-E	UFC-D MOD-F	MOD-S MOD-D	PARA CRC-DATA IO
F1 F2 F3	E4 E5	E6 E7	F8 F9 F10

Type the two numerical digits that are in front of the filename and the content of the file can be viewed. Page down is activated by SPACE key.

It is save to use the function keys at any time during viewing the file to switch to other windows.



4.9.8 Service menu: F9 CRC checksum window

As an extra service the CRC-checksums per file can be viewed, so in case of a change in a initialisation file it can be seen in this window which file has changed.

MAIN INT UFC-E F1 F2 F3	UFC-D MO F4	D-E MOD-S F5 F6	MOD-D F7	PARA CRC- F8 F	-DATA IO 9 F10
Serial#:2325741001 Tag #:51-FT-002 Version:03.00.50.01 Data :exe00000-1842	Window : Warnings: Alarms : 1-43067-01 <u>275</u>	CRC-DATA 2 3	Batch Printe Ltask DUMMY	: NON r: CHECK : NON : <mark>NORMAL</mark>	KROHNE Altometer (C) 2008 14:26 ♥
crc_norm.dat:	01275	Last update	: : Sep (05 08:09:08	2008
crc_date.dat:	30622				
tick0300.dat:	61087				
clnt0300.dat:	16193				
syst0300.dat:	14095				
coms0300.dat:	50273				
crc_norm.ufp:	43067	Last update	: : : Sep (03 08:56:50	2008
crc_date.ufp:	52193				
defmp.ufp:	50251				
defad.ufn:	11874				
mnca0300.ufp:	27037 14348				
hset0300.ufp:	24789				
crc_norm.ufs:	18421	Last update	: : : Aug (94 18:54:06	2008
crc date.ufs:	22573				
swr10300.ufs:	12938				
flow0300.ufs:	38269				
FILE TYPE:	CRC-CHECKSUM				

Note that the CRC_NORM file CRC checksums are also at the bottom of the Status window This file holds the CRC checksums of the other files in the data set. So when anything changes in a file in the data set this also changes the CRC_NORM CRC-checksum.

Extra since software version 03.00.50.00 is that these CRC checksums are also printed to a text file CRC_VAL.RAP each program start-up. This is for easy checking any file changes later on.



4.9.9 Service menu: F10 IO window

All secondary inputs and all outputs other then Modbus can be seen in this window

INPUT	AD CARD	INPUT MOI	DBUS	INPUT F	REQUENCY	OUTP	UT ADCARD
	[mA] ch	Read new	J[S]	[Hz] ch n	ew[s] fund	: DO c	h funct
Tbody -20	.028 01					- 00	1 Warn. bfm
Tproc -20	.028 01					- 00	2 Alarm bfm
Tprov -						- 00	3 Warn. sysrun
T dens -20	.053 03					- 00	4 Alarm sysrun
Pproc -20	.055 02					- 00	5 Warn. sússet
Pprov -						- 00	6 Oor AD Éodu
Pdens -20	.048 04					- 00	7 Oor D15 🥤
Ddens -20	.418 06					- 00	8 Hold corr
Dstan -						- 00	9 Reserved
Visco -						- 01	0 Oor AD temp
BS&₩ –						- 01	1 Oor AD pres
						0 1	2 Oor AD dens
						0 1	3 Bfm oor
						0 1	4 Bfm path
						0 1	5 Bfm dev c
						0 1	6 Bfm com
INPUT	DI	OUTPUT	MP103	OUTPUT	ADCARD		
Reset Tot	als	4.0000	[mA]Qu	0.0000	[V]Qu	DO c	h funct MP103
Reset Ala	rms	0.00	[Hz]Qu	0.0000	[V]Qu	1 0	0 Dir -flow
		0.00		0.0000		1 0	1 Alarm hfm
						0 0	2 Warn, hfm
						1 0	3 Dir +flow
						¥ V	5 511 -110
Serial#:2	325741001	Wir 	ndow IC)-PARAM	Batch	: NON	KROHNE
1ag #:5	1-FI-002	War	nings:2		Printe		Altometer
Data :e	xe00000-184	21-56309-	-31865		DUMMY	: NOBMA	
MOTN			D MOD-I	E MOD-S	MOD-D	PORO	
F1	F2 F3	F4	E5	E F6	F7	F8	F9 F10

Under normal circumstances it is not necessary to view this window.

Input secondary signals

The signals for temperatures pressures densities and viscosity can be input by AD Card, Modbus or Frequency Input.

The configuration of these signals is in the CLNT0300.dat file.

When setting up analog and digital I/O signals this window shows the signals for the AD card and MP103 card of the UFP-V. Per card functions can be enabled / disabled card through off-line software settings.

AD card configuration	: see chapters DATA ACQUISITION and OUTPUT
MP103 card configuration	: see chapters DATA ACQUISITION and OUTPUT



CALCULATION OF STANDARD VOLUME AND MASS 5

The principle of the UFP-V is measuring the volumetric proces flow rate. Integrating this value in time results in the volumetric proces total.

Often measured quantities are compared. Because of temperature and pressure dependency of the volumetric proces it can be preferable to convert to more standard conditions:

- Volumetric standard (1.01325 bar and for example $15 \,^{\circ}$ C).
- Mass

5.1 Volumetric standard

The correction of the volumetric proces to volumetric standard is done according to API/ASTM-IP standards.

The volume correction factor VCF can be divided into:

- Correction for the temperature dependency, using API 11.1 standard 2540 equation and constants, resulting in a correction factor Ctl
- Correction for the pressure dependency, using API 11.2.1M equation and constants, resulting in a correction factor C_{nl}.

$$VCF = C_{tl} \cdot C_{pl}$$

$$Vol_{stand} = Vol_{proces} \cdot VCF$$

VCF

: Volume correction factor C_{tl} : Temperature correction factor

 $\boldsymbol{C}_{\text{pl}}$: Pressure correction factor

Vol_{stand} : Volumetric standard [m3]

: Volumetric proces [m3] Volproces

Also available after calculation is the density at proces conditions. This means that mass is also calculated.

5.1.1 Calculation of correction temperature dependency C_{tl}

The correction for the temperature dependency to the 15° reference base:

$$C_{tl} = EXP[-\alpha_T \cdot (T_{process} - 15) \cdot (1 + 0.8 \cdot \alpha_T \cdot (T_{process} - 15))]$$

Ctl : Temperature correction factor

: Thermal expansion coefficient [1/°C] α_T

 T_{proces} : Temperature proces [°C]

In this, the equation is independent of the group or substance. It can be used with any valid method of obtaining the thermal expansion coefficient for a given fluid, as long as a statistically significant number of points is obtained. A minimum of ten such points is recommend. In addition, the values of the constants K_0 , K_1 and K_2 are given for each major group.

These constants relate the thermal expansion coefficient to base density by :

$$\alpha_T = \frac{K_0}{\rho_{15}^2} + \frac{K_1}{\rho_{15}} + K_2$$

: Thermal expansion coefficient [1/°C] α_{T}

: Density at reference 15 °C [kg/m³] ρ_{15}

 K_0, K_1, K_2 : Constants, depending on the type of the product

The API table for the 15 °C reference base as installed in the UFP-V is:





Type of product	Low limit p ₁₅	High limit ρ_{15}	K ₀	K 1	K ₂
	[kg/m3]	[kg/m3]			
Crude	610.5	1075.0	613.9723	0	0
Gasoline	653.0	770.0	346.4228	0.4388	0
Trans.area	770.5	787.5	2680.3206	0	-0.00336312
Jet group	788.0	838.5	594.5418	0	0
Fuel oil	839.0	1075.0	186.9696	0.4862	0
Free fill in	500.0	2000.0	0	0	0

Practical rule: The correction per °C is approximately 0.05% - 0.15% depending on conditions and type of product.

Standard temperature different from 15℃:

The method is based on a reference standard of $15 \,$ °C. For example if the proces temperature is $65 \,$ °C.

$$C_{tl} = C_{tl65 \to 15}$$

If the required standard temperature is different from $15 \,^{\circ}$ C the correction for the difference is introduced. For example if the standard temperature is $20 \,^{\circ}$ C,

$$C_{tl} = \frac{C_{tl65 \to 15}}{C_{tl20 \to 15}}$$

Note: If the standard temperature is different from 15 °C the density limits per product type also change. The UFP-V calculates the limitations for the installed standard temperature. A density can not be filled in beyond limitations. The Free Fill product type is for uncommon products, K0, K1 K2 are adjustable.

5.1.2 Calculation of correction pressure dependency C_{pl}

The basic mathematical model, used to develop this standard, relates the compressibility factor exponentially to temperature and the square of the molecular volume. That is:

$$F = EXP[-1.62080 + 0.00021592 \cdot T_{process} + \frac{0.87096}{\rho_{15}^{2} \cdot 10^{-6}} + \frac{0.0042092 \cdot T_{process}}{\rho_{15}^{2} \cdot 10^{-6}}]$$

F : Compressibility factor, [1/kPa]

 T_{proces} : Temperature proces [°C]

 ρ_{15} : Density at 15 °C [kg/m³]

The compressibility factor F is used in the normal manner of volume correction to make the correction for the pressure effect:

$$C_{pl} = \frac{1}{1 - F \cdot P_{process} \cdot 10^{-4}}$$

 C_{pl} : Pressure correction factor

F : Compressibility factor

P_{proces} : Pressure proces [bar]

Practical rule: The correction per bar is approximately 0.005% - 0.015% depending on conditions and product.



5.1.3 Operating with the standard density

Products with a known constant homogeneous standard density do not need to be monitored by a densitometer.

Input of the standard density can be

- Manually in the running UFP-Program
- Through Modbus
- Analog input

It is named standard density and not density 15 because of the possibility to have a standard temperature different from 15℃.

The density at 15 °C is calculated through iteration by the input of the standard density in a maximum of 40 steps or a remainder REM less then 10^{-5} :

Diagram for calculation VCF from standard density input:



Input for calculating density at 15°C:

- T_{standard} :[°C] Temperature standard
- ρ_{standard} :[kg/m³] Density standard
- Product type
- Start value for density at 15°C is the mean value of the high and low limits of the required product type.

In a maximum of 40 loops:

- Calculate the thermal expansion coefficient α_T with the new found density 15
- Calculate the C_{tl} factor (C_{tl standard -->15)})
- Calculate the new reference density at 15 °C by:

$$\rho_{15} = \frac{\rho_{s \tan dard}}{C_{tl(s \tan dard-15)}}$$

- Calculate the difference between the new found density15 and the last found density15. If the difference is smaller then 0.001% then the new found density15 is correct, otherwise use the new found density15 as new input.
- If the density 15 after 40 loops is not found then an alarm is shown on screen and through Modbus communication.

So now the density at 15 ℃ is found.



5.1.4 Operating with the measured density

For less homogenous products like Crudes it is more practical to measure the density. The density at 15° C is calculated through iteration by the input of the measured density in a maximum of 40 steps or a remainder REM less then 10^{-5} .

Diagram for calculation VCF from measured density input:



Input for calculating density at 15°C:

- T_{dens} :[°C] Temperature densito meter
- P_{dens} :[bar] Pressure densito meter
- ρ_{dens} :[kg/m3]Density densito meter (measured density)
- Product type
- Start value for density at 15 °C is the mean value of the high and low limits of the required product type.

In a maximum of 40 loops:

- Calculate the thermal expansion coefficient α_T with the new found density 15
- Calculate the C_{tl} factor ($\dot{C}_{tl Tdens -->15}$)
- Calculate the C_{pl} factor. $(C_{pl Pdens})$
- Calculate the new density at 15°C by:

$$\rho_{15} = \frac{\rho_{dens}}{C_{tldens} \cdot C_{pldens}}$$

- Calculate the difference between the newfound density15 and the last found density15. If the difference is smaller then 0.001% then the newfound density15 is correct, otherwise use the newfound density15 as new input.
- If the density15 after 40 loops is not found then an alarm is shown on screen and through Modbus communication.

So the density at 15° C is found.

Practically the conditions (T, P) for the densitometer can differ from the conditions of the measured flow rate in the UFS-V.

Therefore, the VCF that is eventually used, is calculated using the found density at 15 °C as its base and the conditions of the measured flow rate as its goal.



5.2 Mass calculation

For mass calculation without using API standard volume calculations for the proces density it is of great importance that its measurement conditions are approximately similar to the measurement conditions of the flow rate in the UFS.

 $\phi_m = \phi_v \cdot \rho$

- Φm : Mass flow rate [kg/hr], the unit used in UFP is [ton/hr], 1 [ton] is 1000 [kg]
- : Volume flow rate at proces conditions Фν
- : Density at proces conditions [kg/m³] ρ

Any deviation in measured density as function of the measurement conditions is directly proportional in the calculation of the mass flow rate.

For example: Crude oil with flow measurement at 25 °C and density measurement at 24 °C. Density 25 °C: 845.00 kg/m3 Density 24 °C: 845.71 kg/m3

This gives a deviation in mass flow rate of:

$$\frac{845.71 - 845}{845} \cdot 100 = 0.08\%$$

So variations of the measurement conditions for densitometer position to flow rate position will effect linearity and repeatability of the mass measurement.

When this problem occurs it is better to use the API standard volume calculation for its mass calculation. Its a little more complicated but then there is a correction for the measurement conditions.

5.3 Solartron meter density is calculated as follows:

Density calibration at 20 °C, 1 barA. Density temperature and pressure corrected:

$$D = K0 + K1 \cdot T + K2 \cdot T^2$$

$$D_t = D(1 + K18(t - 20)) + K19(t - 20)$$

$$D_p = D_t (1 + K20(p-1)) + K21(P-1)$$

Where K20 and K21 are:

$$K20 = K20A + K20B(p-1)$$

 $K21 = K21A + K21B(p-1)$

- : Density, uncorrected [kg/m³] D
- : Density, temperature corrected [kg/m³] Dt
- : Density, pressure corrected [kg/m³] Dn
- : Periodic time [µs] Т t
- : Temperature [°C] : Pressure [barA]

K0, K1, K2 : Calibration factors, Density calibration at 20 °C, 1 barA.

K18, K19 : Calibration factors, Density calibration at 20 °C, 1 barA.

- K20A,K20B: Calibration factors, Density calibration at 20 °C, 1 barA.
- K21A,K21B: Calibration factors, Density calibration at 20 °C, 1 barA.

The calibration factors can be altered on-line while the system is operating, by keyboard (CONTROLS F9, DENSITO F5) or by Modbus control.

But for custody transfer reasons the write access to the density cells can be blocked in the configuration file CLNT0300.DAT



t

5.4 Sarasota meter density is calculated as follows:

$$T_{0}^{'} = T_{0} + N_{t}(t - t_{cal}) + N_{p}(p - p_{cal})$$

$$\rho_{m} = D_{0} \cdot \frac{T - T_{0}^{'}}{T_{0}^{'}} \cdot (2 + K \cdot \frac{T - T_{0}^{'}}{T_{0}^{'}})$$

- : Calculated measured mass density of fluid [kg/m³] ρ_{m}
 - : Measured periodic time [µs]
- T₀' : Corrected value of T₀ [µs] Τ₀
 - : Calibration factor, reference periodic time [µs] of spool at 15 °C and zero density
 - : Absolute temperature [K]
 - : Calibration factor, calibration temperature used in density calculations [15°C]

 - : Calibration factor, calibration pressure used in density calculations [1:0 0] : Calibration factor, calibration pressure used in density calculations [1.01325 bar] : Calibration factor, temperature coefficient of spool [µs/K]
- t_{cal} p p_{cal} N_t
- N_p : Calibration factor, pressure coefficient of density transducer [µs/bar]
- : Calibration factor, calibration constant of spool [kg/m³] : Calibration factor, spool calibration constant [] D_0^p
- Κ

The calibration factors can be altered on-line while the system is operating, by keyboard (CONTROLS F9, DENSITO F5) or by Modbus control.

But for custody transfer reasons the write access to the density cells can be blocked in the configuration file CLNT0300.DAT



6 BATCH MODE

In batch mode the UFP-Program generates batch tickets by manual demand, Modbus controlled demand or time controlled demand.

These batch tickets are printed by a serial printer, according to DIN66258 standard

The latest MID certification holds the following printer setups:

- EPSON 880 serial printer with DIN66258 protocol
- Printer OKI 280 elite (Standard Serial Printer) + MFX_4 SDI module The MFX_4 SDI Serial Data Interface is for transmission of legal data (DIN66258 protocol) to a standard printer.

6.1 Hardware set-up

The hardware set-up concerning Baud rate, stop bits etc. of the serial printer port is defined in an initialisation file used for all communication settings: COMS0300.DAT Under section 2:

These settings <u>must also be done</u> at the printer side.

6.2 Layout of the ticket

The layout of the ticket is fixed in a file named TICK0300.DAT (see next page)

This file can be configured as required.

The file is protected by a CRC-checksum as all initialisation files are.

The CRC-checksums from the 3 data sets used (UFS, UFP and DAT) are printed on the ticket for additional security. Any change in the ticket layout is identified by a change in CRC-checksum. The layout of the ticket consists of free to fill in text and data.

The data is framed as follows:

~	1 or 3	1 to 999	L or R	@
Frame	1=batch start value	Parameter	Optional alignment	Frame
Start	2=batch stop value	Mapping	Left or right	End
character	3=special character input	address	Default is R	Character

If the data needs to be printed in a specific format (by default the values are printed in format %10.3)

~	1 or 2	1 to 999	L or R	%	1 to 15	-	0 to (Width-1)	@
Frame	1=start value	Parameter	Optional	Indicator	Width, number	Period as	Number of	Frame
Start character	2=stop value	Mapping address	alignment Left or right Default is R	For specific format	of characters to print	decimal point	characters in decimal	End Character



Example of ticket layout in file TICK0300.dat:

<pre>~3027@~3087@~3049@ ~3027@~3087@~3048@ IDENTIFICATION Ticket number : ~1001L@ Start time : ~1101L@ Stop time : ~2101L@ Software version: ~1201L@ Software version: ~1202L@ Tag number ID : ~1203L@ Batch ID : ~1204L@ Batch name : ~1205L@</pre>	KROHNE	
TOTALISERS Proces[m3] Start Cum.:~1401R%10.2@ ~ Stop Cum.:~2401R%10.2@ ~ Batch :~2301R%10.2@ ~	Standard[m3] Mass[tonM] ~1404R%10.2@ ~1407R%10.2@ ~2404R%10.2@ ~2407R%10.2@ ~2304R%10.2@ ~2307R%10.2@	
BATCH FLOW WEIGHTED AVERAGES Temperature[°C] Proces : ~2502R%8.2@ Densito meter: ~2504R%8.2@ Standard : ~2519R%8.2@	Pressure[bar] Density [kg/m3] ~2505R%8.20 ~2520R%9.30 ~2507R%8.20 ~2508R%9.30 ~2509R%9.30	
CONFIGURATION ON STANDARD VOL Calculation Method : ~2 Temperature standard [°C]: ~2 Density standard by : ~2 Api group fluid type : ~2 API correction factor K0 : ~2 API correction factor K1 : ~2 API correction factor K2 : ~2	LUME CALCULATION 2701L@ 2702L%5.2@ 2703L@ 2704L@ 2705L%11.4@ 2706L%11.4@ 2707L%11.8@	
ALARMS Temperature Body Temperature Proces Temperature Densitometer Pressure Densitometer Density Proces Density Standard	Measured[s]Override[s~2606R%10.10~2616R%10.11~2607R%10.10~2617R%10.11~2609R%10.10~2619R%10.11~2610R%10.10~2620R%10.11~2612R%10.10~2622R%10.11~2613R%10.10~2623R%10.11~2614R%10.10~2624R%10.11] @ @ @ @ @ @ @
General Flow 1-4 channels dow General Flow all channels dow	wn : ~2601R%10.10 wn : ~2602R%10.10 ch : ~2603R%10.10	

For the specific parameter mapping addresses see next paragraph



6.3 Parameter mapping addresses

Tick	et number	Operation
1	Non resetable sequence number for the batch	В
2	99 reserved	
Time	S	Operation
101	Time and date of start and stop	В
102	199 reserved	
Oper	rate names (optional at batch set-up)	Operation
201	Serial number (internal)	В
202	Software version (internal)	В
203	Tag number ID (internal)	В
204	Batch ID (fill in optional)	В
205	Batch name/source (fill in optional)	В
206	Batch reference number (only accessible by Modbus input)	В
207	209 reserved	В
210	Guard Digital contact, text according to CLNT0300.DAT item 20.04 and 20.05 See also chapter 10.4.3	E
211	220 reserved	
221	Print Modbus ASCII 8 character write string, Modbus address (NotModicon compatible) 4001	E
222	Print Modbus ASCII 8 character write string, Modbus address (NotModicon compatible) 4002	E
223	Print Modbus ASCII 8 character write string, Modbus address (NotModicon compatible) 4003	E
224	Print Modbus ASCII 8 character write string, Modbus address (NotModicon compatible) 4004	E
225	260 reserved	
261	Print Modbus ASCII 16 character write string, Modbus address (NotModicon compatible) 14001	E
262	Print Modbus ASCII 16 character write string, Modbus address (NotModicon compatible) 14002	E
263	Print Modbus ASCII 16 character write string, Modbus address (NotModicon compatible) 14003	E
264	Print Modbus ASCII 16 character write string, Modbus address (NotModicon compatible) 14004	E
265	299 reserved	
Rese	etable Totalisers (at start and stop time)	Operation
301	Resetable Actual Totaliser	В
302	Resetable Actual forward Totaliser	В
303	Resetable Actual reverse Totaliser	В
304	Resetable Standard Totaliser	В
305	Resetable Standard forward Totaliser	В
306	Resetable Standard reverse Totaliser	В
307	Resetable Mass Totaliser	В
308	Resetable Mass forward Totaliser	В
309	Resetable Mass reverse Totaliser	В
310	Resetable External Flow meter Standard Totaliser	E
311	Resetable External Flow meter Standard Forward Totaliser	E
312	Resetable External Flow meter Standard Reverse Totaliser	E
313	399 reserved	
Non	Hesetable Lotalisers (at start and stop time)	Operation
401	Non resetable Actual Totaliser	B
402	Non resetable Actual Forward Totaliser	B
403	Non resetable Actual Reverse Totaliser	В
404	Non resetable Standard Totaliser	B
405	Non resetable Standard Forward Total	B



406	Non resetable Standard Reverse Total	в
407	Non resetable Mass Totaliser	B
408	Non resetable Mass Forward Totaliser	B
409	Non resetable Mass Reverse Totaliser	В
410	499 reserved	
Batc	h Flow weighted averages	Operation
501	Batch 1 average temperature body	B
502	Batch 1 average temperature proces	В
503	Batch 1 average temperature proving external flow meter	Е
504	Batch 1 average temperature densito meter	В
505	Batch 1 average pressure proces	В
506	Batch 1 average pressure proving external flow meter	Е
507	Batch 1 average pressure densito meter	В
508	Batch 1 average density densito meter	В
509	Batch 1 average density standard	В
510	Batch 1 average External Viscosity kynematic	В
511	Batch 1 average Ctl (15 ℃ to proces)	В
512	Batch 1 average Cpl (0 Bar to proces)	В
513	Batch 1 average Ctl (15℃ to standard)	В
514	Batch 1 average Cpl (0 Bar to standard, always 1)	В
515	Batch 1 average Ctl (15°C to densito meter)	В
516	Batch 1 average Cpl (0 Bar to densito meter)	В
517	Batch 1 average Ctl (15°C to proving external flow meter)	В
518	Batch 1 average Cpl. (0 Bar to proving external flow meter)	В
519	Batch 1 average temperature standard	В
520	Batch 1 average density proces	В
521	Batch 1 average flow actual	В
522	Batch 1 average density proving external flow meter	Е
523	Batch 1 average flow proving external flow meter	E
524	Batch 1 average Installed Kfactor proving external flow meter	E
525	Batch 1 found New Kfactor proving external flow meter	E
526	Batch 1 difference installed vs new found Kfactor external	E
527	Batch 1 Air Buoyancy correction: Air Buoyancy number CLNT0300.DAT item 19.02	E
528	Batch 1 Air Buoyancy correction: Calculated Liter Weight	E
529	Batch 1 Air Buoyancy correction: Calculated Weight in Air	Е
530	550 reserved	
551	Batch1 : Lowest measured Temperature (for high viscosity applications)	В
552	Batch1 : Deviation % (worst case estimate due to batch alarms)	В
553	599 Reserved	
Batc	h alarms in seconds	Operation
601	Batch 1 alarm: General Flow 1-4 channels down	В
602	Batch 1 alarm: General Flow all channels down	В
603	Batch 1 alarm: calculation API group mismatch	В
604	Batch 1 alarm: system runtime alarm occurred	В
605	Batch 1 alarm: real time profile out of range when used	В
606	Batch 1 alarm: measured Body temperature out of range	В
607	Batch 1 alarm: measured Proces temperature out of range	В
608	Batch 1 alarm: measured External Prove temperature out of range	E
609	Batch 1 alarm: measured Densito temperature out of range	В
610	Batch 1 alarm: measured Proces pressure out of range	В
611	Batch 1 alarm: measured External Prove pressure out of range	E



i i		I
612	Batch 1 alarm: measured Densito pressure out of range	В
613	Batch 1 alarm: measured Densito Density out of range	В
614	Batch 1 alarm: measured Standard Density out of range	В
615	Batch 1 alarm: measured External viscosity out of range	E
616	Batch 1 alarm: override Body temperature applied	В
617	Batch 1 alarm: override Proces temperature applied	В
618	Batch 1 alarm: override External Prove temperature applied	E
619	Batch 1 alarm: override Densito temperature applied	В
620	Batch 1 alarm: override Proces pressure applied	В
621	Batch 1 alarm: override External Prove pressure applied	E
622	Batch 1 alarm: override Densito pressure applied	В
623	Batch 1 alarm: override Densito Density applied	В
624	Batch 1 alarm: override Standard Density applied	E
625	Batch 1 alarm: override External viscosity applied	В
626	627 reserved	
Conf	iguration API etc	Operation
	Calculation method: Only proces flow, Standard volume/mass by API standards, mass	
701	measurement by proces density	В
702	Temperature standard in value	В
		_
703	Density standard by: fill in manually, calculated from densito meter density, on AD / Modbus input	В
704	Fluid type: crude, gasoline, trans.area, jetgroup, tuel oil, tree till	В
705	API correction factor K0	В
706	API correction factor K1	В
707	API correction factor K2	В
708	749 reserved	
750	Print Modbus float32, Modbus address (NotModicon compatible) 7095 (1751) or 7100 (2751)	E
751	Print Modbus float32, Modbus address (NotModicon compatible) 7096 (1752) or 7101 (2752)	E
752	Print Modbus float32, Modbus address (NotModicon compatible) 7097 (1753) or 7102 (2753)	E
753	Print Modbus float32, Modbus address (NotModicon compatible) 7098 (1754) or 7103 (2754)	E
754	Print Modbus float32, Modbus address (NotModicon compatible) 7099 (1755) or 7104 (2755)	E
755	Print Modbus float32, Modbus address (NotModicon compatible) (7095 – 7100) (with 1756) (7100 – 7095) (with 2756)	F
	Print Modbus float32, Modbus address (NotModicon compatible) (7096 – 7101) (with 1757)	
756	(7101 – 7096) (with 2757)	E
757	(7102 - 7097) (with 2758)	Е
	Print Modbus float32, Modbus address (NotModicon compatible) (7098 - 7103) (with 1759)	
758	(7103 – 7098) (with 2759) Print Madhus flaat22, Madhus address (NatMadison compatible) (7000 – 7104), (with 1760)	E
759	(7104 – 7099) (with 2760)	Е
760	799 reserved	
Secu	ırity	Operation
801	CRC checksum on data set UFS	В
802	CRC checksum on data set UFP	В
803	CRC checksum on data set DAT	В
804	CRC checksum on Executable	В
805		

Operation B: Basic operations Operation E: Extended operations



6.3.1 Special characters for printer control:

Special characters for printer control start with a 3.

The so called escape codes for printer of	control can be inserted into the Ticket Layout
Examples:	
~3007@	Printer sounds a bel
~3012@	Formfeed
~3027@~3067@~3000@~30xx@	Set page length in inch in ~30xx@: xx=122
~3027@~3067@~3000@~3xxx@	Set page length in lines in ~3xxx@: xx=1127
~3027@~3087@~3049@	Select double sized characters
~3027@~3087@~3048@	Cancel double sized characters
~3027@~3071@	Select double strike printing
~3027@~3072@	Cancel double strike printing
~3027@~3052@	Select italic characters
~3027@~3053@	Cancel italic characters
~3027@~3054@	Cancel italic characters
~3027@~3057@	Enable paper out sensor
~3027@~3056@	Disable paper out sensor

6.4 Initial batch set-up

The initial batch set-up is by initialisation file CLNT0300.dat file under section 12:

12 <batching control=""></batching>
Only in use when a Epson Serial Printer according DIN66258 standard
is connected.
Note that in the HSET0300.UFP file (for hardware setup) the following data
must be set:
-1.4 Location_stat must be enabled (saving of status)
-1.8 Location_tic must be a disk with enough storage capacity
12.1 BATCHING_ON c=#2 //0=Internal batching disabled
//Manual batching modes:
//l=Enable Batching (start stop at zero flow)
//2=Enable Batching (start stop at all flows)
//Continuous piipe line modes
//3=Enable Batching: (Automatic)
<pre>//4=Enable Batching: (No Reset, possibly forced reset)</pre>
<pre>//If enabled then automatic initialize printer</pre>
12.2 Max_tickets c=#100//Maximum number of last tickets saved 10100000
//depending on disk space (see Location_tic above)
12.3 Hour_start c=#10 //Start hour 023 for continous pipe line ticket
12.4 Hour_interval c=#1 //Interval hour 124 for continous pipe line ticket
//O=No tickets automatically, only on demand
12.5 Modbus_control c=#1 //0=No Control batching through modbus
//1=Control batching through modbus
//2=as 0 with no printer alarm on printer failure
//3=as 1 with no printer alarm on printer failure

• There are 4 modes for Batch configuration:

BATCHING ON	Start stop batch permission	Confirmation asked on batch settings	API settings during batch possible
0	Batch mode disabled		
1	Only at zero flow conditions	Yes	No
2	At all flowing conditions	Yes	No



3	At all flowing conditions	No	Yes (continuous pipe line measurement)
4	At all flowing conditions	No	Yes (continuous pipe
			line measurement)

BATCHING_ON 1 and 2 have the following restrictions during a batch: -No reset possible of resetable totalisers

-No reset of error times but the possibility to reset occurred error messages

- The previous number of tickets saved is set with MAX_TICKETS. Default is 100 tickets. Be careful with increasing the number of tickets. Not enough disk space means losing tickets
- For Continuous Pipe Line Measurement the ticket automatically is printed starting from HOUR_START
- For Continuous Pipe Line Measurement the ticket automatically is printed every HOUR_INTERVAL, but if interval 0 is installed than tickets are only printed on demand
- By MOD_BUS_CONTROL it is possible to enable the controls through Modbus for batching: -Start batch
 - -Stop batch
 - -Reset printing
 - -Confirm printing
 - Or in case of using continuous Pipe Line measurement
 - -Ticket on demand with reset of values
 - -Ticket on demand without reset of values
 - Reset printing

6.5 Batch status

Batch status	As a value on	Explanation
(status window text)	Modbus	
NON	0	No batch active, ready to set-up
SETUP	1	In set-up mode. After set-up is done, it is possible to start a batch
RUNNING	2	Batch is started
END-BATCH	3	Batch is stopped and ticket is made, then attempt to END_PRINT
END-PRINT	5	Status during successful printing
END-FAIL	6	If printing fails or printer is busy too long
CONFIRM	7	After successful print job waiting for manual confirmation
RESET	10	Waiting for reset command after END_FAIL



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6.6 Printer status

Printer status (status window text)	As a value on Modbus	Explanation
Ready	0	Ready for printing
Fail	1	If printer failed during print job
Busy	2	During print job
Check	2	If no print job, check if printer is connected and ready
Off	3	If printer is not found after Check

6.7 Printer task status

Printer status	As a value on	Explanation				
(status window text)	Modbus					
NON	0	No print job				
BUSY	12	Attempt first character				
Xxxs0s	3	Getting acknowledge if printer is taking print job.				
Timeout print management		For multiple UFP's connected by a printer switch to 1				
Value in seconds counting		serial printer. Timeout print management can be set in				
down, if 0 then status to		COMS0300.dat under section 2.9				
RESET						
BUSY	498	Printing headers				
Progress counter as	99	Successful printing ticket				
percentage 0100						
CONFIRM	100	Ready to confirm print job, see batch status CONFIRM				
RESET	101	Ready for reset command on batch status RESET				



6.8 Batch set-up

BATCHING_ON 1 or 2 is a normal batch that requires batch set-up:

BATCH CONTROL WINDOW			
The batch option is configured as	follows		
Start stop batch permission	: At all	flow conditions	
Confirmation asked on API/strings	: Yes		
API settings during batch	: No		
Current ticket number		28	
Current status is no batch active			
F1 : Back to main window			
F2 : Setup a new batch (API sett	ings and ficke	et strings)	
F3 : Previous Licket Read/Print			
Serial#:2325741001 Window :	BATCH CONTROL	Batch : NON	KROHNE
Version:03.00.50.01 Alarms	1		Altometer (C) 2008
Data :exe00000-18421-56309-31865		DUMMY : NORMA	17:20 📢
MAIN SETUP READ F1 F2 F3 F4 F	-5 F6	F7 F8	F9 F10

A new batch can only be set if the last batch is stopped and the ticket is printed correctly and confirmed Start the set-up by pressing function key F2 for confirmation on the API settings

API STANDARD VOLU	JME/MA	SS CONFIGURA	TION D	та				
Calculation		DISABLED STANDARD V MASS MEASU	DLUME∕M Rement	iass by By pro	API STAN CES DENSI	DARDS TY		
Temperature stand	lard:	<mark>۲ 15.000 د</mark> ۰	C I					
Density standard	by:	FILL IN MA CALCULATED ON AD/MODB	NUALLY FROM D US INPU	ENSITO T	1eter den	SITY		
Fluid type		CRUDE GASOLINE TRANS.AREA JET GROUP FUEL OIL FREE FILL		API254 Temper -18 -18	0 Table ature[°C 150 125 95	54C tempe] current:	Alph 486 918 954	re limits na*1e-6 918 954 1674 1453.2
Density standard		► 650.00 CK	g/m3]	unda a				
ко к1 к2		613.972 0.00000 0.00000	<pre><change <arrow="" <b="" <enter:="" <i="" n="" p:=""></change></pre>	up/dow left/r <1,2,	ight): In 3> : Se ight): In 3> : no ; Sa	et param. croll/Cha crease s ormal, °A ove confi	/valu nge v tep v PI 60 gurat	e-change alue , SG ion
Serial#:232574100 Tag #:51-FT-002 Version:03.00.50. Data :exe00000-	1 01 18421-	Window Warnings Alarms 56309-31865	: BATCH : 2 : 1	API	Batch Printe Ltask DUMMY	: NON er: CHECK : NON : <mark>NORMA</mark>		_KROHNE] Altometer (C) 2008 17:23 ♥
BATCH ENTER F1 F2	UP E3		EFT 5	F6	INP1 F7	INP2 F8	INP3	B SAVE

The operator is forced to look at the API setting. He can change the settings and SAVE by F10 or return back to BATCH by F1.

If the batch is controlled by Modbus this step must be handled by the Host system.



6.8.2 Batch text set-up

On returning from API settings the strings can be set:

BATCH STRING INPUT	WINDOW			
Batch ID	: Fuel0i123			
Batch name/source	Tank56c			
Serial#:2325741001	Window :BATCH	TEXT Batch	: SETUP	KROHNE
Tag #:51-FT-002	Warnings:2	Printe	er:OFF	Altometer
Data :exe00000-184	HIAMS : 1 121-56309-31865	DUMMY	: NORMAL	

Returning to F1 "batch" means confirmation on texts. Confirmation on Batch ID and Batch name/source is only possible with manual set-up

Note that there are now also Modbus ASCII based strings available.

By data input through Modbus, 4 names (8 characters) and 4 names (16 characters) can printed on the ticket. Also 10 external numeric values by Modbus input can be printed on the batch ticket, see printer registers 751...760

6.8.3 Ready to start batch after set-up is complete

Curren F1 : F2 : F3 : F4 : F10 : Serial#	t statu Back f Cance Setup Setup Start : 232574	us is bat to main w I the set the API the Stri the batc	ch setup a rindow up ngs :h Window	and ready	to start	Batch	: SETUP	Квон	NE
Tag # Version Data F1	: 51-FT : 03.00 : exe000 CANCEL F2	-002 .50.01 000-18421 . Set-AP F3	Warnir Alarms -56309-318 I Set-text F4	195:2 5:1 65 F5	F6	Printer Ltask DUMMY	: CHECK : NON : NORMAL F8	Altone (C) 2 17:48	TABT

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Detels stard



- Now batch is ready to start by Function key F10 or by Modbus command if enabled. Note that depending on security level it is only possible to start a batch if flow is at zero flow conditions
- Possible to cancel the set-up (F2)
- Or return to the API settings (F3) or the Text settings (F4)

Datch Start				
BATCH CONTROL WINDOW				
The batch option is configured as fo	llows			
Start stop batch permission	: At all fl	ow conditions		
Confirmation asked on API/strings	: Yes			
API settings during batch	: No			
Current ticket number		29		
Batch Volume Error [%]	: 0.00			
Current status is batch is running				
F1 : Back to main window				
F2 : Read/print a previous batch t	icket			
F8 : End Batch and write+print tic	ket			
erial#:2325741001 Window :BA	TCH CONTROL F	atch : RUNNING	K	ROHNE
ag #:51-FT-002 Warnings:2	F	rinter: CHECK	A1	tometer
ersion:03.00.50.01 Alarms :2		task : NON	17) 2008 ·52 <u>*1</u>
MAIN READ		END	- 11	
	E6 I	-7 F8	E9	E10

Starting a batch holds the following automatic actions:

- Reset of: errors, resetable totalisers and batch flow-weighted averages (temp, press, densities etc.)
- Increase ticket number by one (is saved in the "batch status" file.
- Saving of all batch parameters (for later use when batch is stopped and certain batch start values are requested on ticket) in a "batch start" file that is secured by a CRC-checksum

New since software version 03.00.50.01 is the option to view, during the batch, the worst case batch Volume Error % estimate due to batch alarms such as path failures, input signals alarms etc etc



6.10 During batch

During a batch the restrictions are handled as the installed BATCHING_ON level prescribes. Files with all alarm times, totalisers, and batch averages are saved every 12 seconds to a SRAM disk (or industrial compact flash with static and dynamic wear levelling) in dual files.

Sequentially saving it each time in a different file (file1 or file2). So when the power is turned of during a file-save causing the file to be corrupted, the previously saved dual file is used at start-up to load previously saved alarm times, totalisers, and batch averages.

6.10.1 Reading / Printing previous batch ticket

During a batch it is possible to read and print a previous batch ticket From Main window to Batch Control window by F7 and then Function Key F2 for reading previous batch ticket

Reading previous tickets WINDOW
Ticket numbers available are: 0000000001 0000000028 Ticket to read is : 0000000028
F1 : Back to main window
F3 : Read requested ticket
F4 F5: In/decrease ticket number
F6 F7: In/decrease step for F4 F5
Serial#:2325741001 Hindow :BATCH CONTROL Batch :NON KROHNE Tag #:51-FT-002 Warnings:2 Printer:CHECK Altomete Version:03.00.50.01 Alarms :2 +task :NON (C) 200 Data :exe00000-18421-56309-31865 DUMMY NORMAL 10:35 0
MAIN BATCH ENTER UP DOWN LEFT RIGHT E1 E2 E3 E4 E5 E6 E7 E8 E9 E10

Explanation Function keys:

•	-
F1	: Back to Main Window

- F2 : Return to Batch Control window
- F3 : Upload "Ticket to read "
- F4...F7 : Change "Ticket to read" number within the limits of "Tickets available"



6.10.1.1 Read ticket

DECISIVE	PRESE	NTATION:	NOT VALID, S	SYSTEM E	ERRORS DU	RING BAT	СН		
System r Realtime	runtime Profil	alarms o le out of	ccurred : range :		83.6 0.0				
Batch Er Low Temp	ror % erature	e during	: batch[°C]:		26.22 21.38				
						K	rohne Oi	låGas B.	.V.
ERROR IN -during -during -during CRC-CHEC	BATCH read/wr making batch: batch: XSUMS:	BY: rite star ticket f system s measurem EXE000000	t-stop data ile topped durin ent alarms p UFS18421 UF	ng batcł nossibl <u>u</u> PP56309) g cause > DAT31865	0.06 % 0 TICxxxx	deviation «	1	
Serial# Tag #	:232574 :51-FT-	1001 -002	Window Warnings	: BATCH	CONTROL	Batch Printer	: NON : CHECK	KR Alto	OHNE ometer
Version Data	:03.00. :exe000	.50.01)00-18421	Alarms -56309-31865			Ltask DUMMY	: NON : NORMAL	(C) 10:4	2008 45 💛
MAIN	BATCH	UP	DOWN E4	E5	E6	F7	F8	PRINT	NEW E10

Notice that the ticket that is read is not valid:

The header explains that there were system errors.

The System errors are mentioned at the bottom of the ticket therefore in this example the reading of the ticket is scrolled down to the bottom.

Function keys:

- F1 : back to Main window
- F2 : back to Batch control
- F3 : Scroll up in ticket
- F4 : Scroll down in ticket
- F9 : Print the ticket
- F10 : Read another ticket


6.11 Batch stop

After starting a batch, this batch can be stopped manually in the Batch Control window by F8, or by Modbus command if enabled

Note that depending on security level it is only possible to stop a batch if flow is at zero conditions



Stopping a batch holds the following automatic actions:

- Saving of all parameters possible (in values) on ticket in a "batch stop" file that is secured by a CRC-checksum.
- Make and save ticket according to the "layout ticket" file that is secured by a CRC-checksum
- If saving of the ticket failed a message will appear on screen and on the ticket.
- The ticket will be send to the printer after saving the ticket



In the picture above the batch is ended and is just started to print. Batch status : END PRINT Printer status : BUSY



Printer task at : 011%

It is always possible to reset the printer buffer in the UFP, this will cause the print task to start at the beginning of the ticket again.

Note that it can be necessary to reboot the printer itself on a real print failure.

Stopping a batch holds the following "manual actions" / "ModBus commands":

- After ticket is printed, confirm the printed ticket is printed successful and is the same as shown on screen.
- If the printing has failed the software generates an alarm and no confirmation can be given only a reset of the printer. Check and reset the printer. After reset, the complete ticket is printed again. If the ticket is printed correct a confirmation can be given.

Note that a next batch can only be started when the previous batch is confirmed.

If any CRC is corrupted this will be indicated on the ticket Printout

- In the header of the ticket, that the ticket is invalid due to system errors
- At the end of the ticket, the explanation of the system errors and so that there was a crc checksum failure

If status batch files are all corrupt at initialisation of the UFP-Program, a new status file is made. The ticket number can then be set to desired value (for logistical reasons) and the DAT data set will have CRC checksum update.

6.11.1 Possible errors that cause an Invalid Batch ticket

In the header of the ticket one of the 3 following messages will be printed

- Decisive presentation: Valid
- Decisive presentation: Not valid, crc-checksum error (ticket)
- Decisive presentation: Not valid, system errors during batch

At the end of the ticket, there will be an explanation of the system errors if they have occurred: Error in batch by:

- During read/write of start/stop value files
- During making ticket file (write errors)
- During batch: batch status files
- During batch: batch totaliser files
- During batch: batch average files
- During batch: system stopped during batch
- During batch: measurement alarms possibly cause > 0.04 percent deviation
- During batch: batch status file saving



6.11.2 Measurement alarms batch validation

There are 2 methods for the batch validation:

- 1. Validation using the maximum flow. This is the method as used in previous versions of this program. Using the maximum flow for validation has shown in practice that it can lead to overrated Batch Error% values.
- 2. Validation using the current flow as long as the current flow is calculated. Since version 03.00.50.01.

The method is set in the CLNT0300.DAT file item: "21.17 Method of weighing"

6.11.2.1 Method 1 static maximum flow

To validate a batch when a measurement alarm has occurred over a period of time (Alarm in [s]) the following calculation is used to validate the batch within a 0.04% error.

$$Volume_error[m3] = \frac{MaxFlow[m3/h]}{3600} \cdot Alarm[s] \cdot \frac{Error[\%]}{100}$$

$$Deviation[\%] = \frac{Volume_error[m3]}{Batch_Volume_proces[m3]} \cdot 100[\%]$$

Secondary inputs measurement Error% on occurred alarm:

Secondary inputs	Error%	Explanation
Temperature body	1	10 ℃ is 0.036% deviation: 2% caused by >500 ℃
Temperature process	25	1 °C is 0.1% deviation: 25% caused by 250 °C deviation
Temperature proving external flow meter	25	1 ℃ is 0.1% deviation: 25% caused by 250 ℃ deviation
Temperature densito meter	25	1 ℃ is 0.1% deviation: 25% caused by 250 ℃ deviation
Pressure proces	2.5	1 bar is 0.01% deviation: 2.5% caused by 250 bar deviation
Pressure proving external flow meter	2.5	1 bar is 0.01% deviation: 2.5% caused by 250 bar deviation
Pressure densito meter	2.5	1 bar is 0.01% deviation: 2.5% caused by 250 bar deviation
Density densito meter	100	Standard volume correction uncertain therefore 100% errror
Density standard	100	Standard volume correction uncertain therefore 100% errror

UFP measurement Error% on occurred alarm:

Secondary inputs	Error%	Explanation
1-4 channels down	0.5	Correction curve over viscosity never > 0.5%. (together with Real time
		profile out of range error will lead to 4% error)
All channels down	100	System is not measuring flow therefore 100% error
API group mismatch	100	Standard volume correction uncertain therefore 100% errror
System alarms	10	Over estimated value on alarms as file not found, overrun etc
Real time profile out of range	3.50	Correction curve over viscosity never > 3.5%. To secure validity value=10%

Each alarm is measured in seconds, and the Volume_Error it causes, is calculated. All Volume_error values are summated and the total deviation is calculated.

Example: How long may a certain error be active during a batch before the batch is Not Valid:

- Only alarm 1-4 channels down: alarm time is x
- Maximum flow rate is 1200m3/h
- Batch time is 24 hours at 80% of the maximum flow rate

The batch volume in 24 hours at 80% flow rate:

*Batch_Volume_*Pr*oces*[*m*3] = 24[*h*]
$$\cdot \frac{80[\%]}{100} \cdot 1200[m3/h] = 23040[m3]$$



For the alarm "1-4 channels down" to be within 0.06% :

$$Volume_error_max = \frac{0.06[\%]}{100} \cdot 23040[m3] = 13.824[m3]$$

$$Alarm[s] = 13.824[m3] \cdot \frac{3600}{1200[m3/h]} \cdot \frac{100}{0.5[\%]} = 8294[s] = 2.3[\text{hour}]$$

6.11.2.2 Method 2 current flow

The calculations are during the batch instead of at the end of the batch. When an error occurs, this error is calculated using the current gross flow as long as not all 5 channels are down (then max flow is used). This leads to less overrated batch volume error% values.

Because the error % is calculated during the batch using the current gross flow it is not possible to recalculate this method at the end of the batch. Only method 1 can be recalculated.

This method prevents overrated batch volume error% during startup where low flow rates and path failures due to gas outbreak can co-exist.

6.12 Continuous Pipeline Measurement tickets

When the BATCHING_ON mode is in Continuous Pipeline Measurement no confirmations are asked after printing the ticket.

If a new ticket has failed in printing it is asked to reset. But if no reset is made then the next ticket will just make the reset and start printing the next ticket.

The previous ticket can then be printed as described in paragraph: Reading / Printing previous batch ticket

There are two options for continuous Pipeline measurement:

- 3 Auto reset of totalisers, errors, averages etc between tickets
- 4 No auto reset of totalisers, errors, averages etc between tickets, but possible on demand.

(clnt0300.dat file section 12.1 option 3 or 4)

For Continuous Pipe Line Measurement the ticket automatically is printed, counting the hours starts from HOUR_START (clnt0300.dat file section 12.3)

For Continuous Pipe Line Measurement the ticket automatically is printed every HOUR_INTERVAL, but if interval 0 is installed than tickets are only printed on demand (clnt0300.dat file section 12.4)



6.13 Example of ticket to output:

DECISIVE PRESENTATION: NOT VALI	D, SYSTEM ERRORS	DURING BATCH
IDENTIFICATION Ticket number : 3 Start time : May 21 18:3 Stop time : May 21 18:5 Serial number : 98843901 Software version: 03.00.00 Tag number ID : F2501 Batch ID : Crude oil23 Batch name : Tank56C	4:46 2001 1:46 2001	KROHNE Altometer
TOTALISERS Proces[m3] Standa Start Cum.: 731.60 Stop Cum.: 757.43 Batch : 25.83	ard[m3] Mas 747.43 773.82 26.39	ss[tonM] 485.83 502.99 17.15
BATCH FLOW WEIGHTED AVERAGES Temperature[°C] Proces : 0.00 Densito meter: 0.00 Standard : 15.00	Pressure[bar] 0.00 0.00	Density [kg/m3] 664.072 500.000 650.000
CONFIGURATION ON STANDARD VOLUM Calculation Method : API2 Temperature standard [°C]: 15.0 Density standard by : Manu Api group fluid type : Crud API correction factor K0 : 613. API correction factor K1 : 0.00 API correction factor K2 : 0.00	E CALCULATION 540 0 ally le 9723 00 000000	
ALARMS Temperature Body Temperature Proces Temperature Densitometer Pressure Densitometer Density Proces Density Standard	Measured[s] : 0.0 : 51.7 : 0.0 : 51.7 : 0.0 : 0.0 : 0.0	Override[s] 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
General Flow 1-4 channels down General Flow all channels down Calculation API group mismatch System runtime alarms occurred Realtime Profile out of range	: 0.0 : 0.0 : 0.0 : 0.0 : 0.0	
ERROR IN BATCH BY: -during batch: measurement alar CRC-CHECKSUMS:EXE00000 UFS35374	ms possibly caus UFP04625 DAT536	e > 0.06 percent deviation 11 TICxxxxx

The alarms on Temperature Proces and Pressure Proces caused a deviation on the Standard Volumes that will be larger then 0.06% therefore the batch is declared not valid. The produced ticket has an incorporated crc checksum that is checked every time the ticket is retrieved from memory to read/print. If this check fails, this is clearly stated on the ticket as ticket Not valid due to crc checksum fail



7 DATA ACQUISITION

Input data can be divided into:

- Data input RS485 card
- Digital inputs MP103 card
- Frequency inputs MP103 card
- Analog inputs AD card

7.1 Data input RS485 card

The data measured by the five converters UFC-V is transferred to the UFP-V by using a half-duplex Krohne communication protocol based on balanced data transmission (RS485).

The Krohne communication protocol requests the five converters for new measured data. The incoming data is first checked on parity-errors, framing-errors, and overruns. The data essentially contains the measured flow from 5 ultrasonic measuring paths, transit time, and error codes. The converter sends data on every request the UFP makes (about every 35ms).



7.2 Digital inputs MP103 card

The MP103 card has 4 digital inputs. The digital inputs are normally open (is 0) The logic level is TTL compatible, maximum 12 VDC.

Channel	Function	Action
no.		
0	Reset measured volume, proces-time and error messages	Make input '1' to reset
1	Reset error messages	Make input '1' to reset
2	Calibration start-signal (KROHNE Altometer use only)	Make input '1' to arm, make '0' to enable
3	Calibration stop-signal (KROHNE Altometer use only)	Make input '1' to arm, make '0' to enable

 The digital input function can be disabled/enabled in the Initialisation files: HSET0300.UFP section 3

- The individual channels can be disabled/enabled in the Initialisation files: CLNT0300.dat section 8
- The signals can be checked on value in the service window IO.
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP Calibration and Verification I/O)



HSET0300.UFP section 3

3.3 MP_Dig_in =#0 //Digital Inputs 0=disable, 1=NC, 2=NO

CLNT0300.dat section 8

```
8 <DIGITAL INPUT CHOICES>
8.1 DI_ZERO_VOL =#1 //0=disable, 1=MP103 CARD 2=ADCARD812/816
8.2 DI_ZERO_ERR =#1 //0=disable, 1=MP103 CARD 2=ADCARD812/816
8.3 DI_START_STOP =#0 //0=disable, 1=MP103 CARD 2=ADCARD812/816
//1f disabled then possible to choose Solartron1 or 2
//see frequency input parameters for further details,
```

7.3 Frequency inputs MP103 card

There are 2 frequency-input channels.

The MP103 card itself can only handle TTL signals. With optional signal converters/barriers a non-TTL input signal can be converted into a TTL signal.

The used crystal oscillator properties are:

Stability 100 ppm over an operating temperature range of 0-70 °C.

Frequency measurement (option on channel 1 and 2):

The frequency-input range is 1-5000 Hz.

The frequency measurement is 24 bit. Multiple pulses are counted over a period of time.

Each frequency measurement takes approximately 8 seconds.

The function is to measure the density input from a Solartron/Sarasota densitometer.

Pulse counter (option on channel 1 only):

The input range is 0-5000 pulse/sec.

The pulse counter is 32 bit. Every 35 ms the counter is read. The counter can reset on demand. It is used for the pulse input from an external flow meter.

Note that the two options are also embedded in the hardware, so depending on the used chipset for channel 1 the option is available.

- The Frequency input function can be disabled/enabled in the Initialisation file: HSET0300.ufp section 3
- The Secondary input parameter can be set in Initialisation file CLNT0300.dat section 9 and 11.
- The signals can be checked on value in the service window IO
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP Calibration and Verification I/O)

HSET0300.ufp section 3

```
3.5 MP_freq_inp1 =#1//Frequency input10=disable, 1=Frequency3.6 MP_freq_inp2 =#0//Frequency input20=disable, 1=Frequency
```

CLNT0300.dat section 9 example density densitometer

DENSI	TY DENSITOMETE	SR	
9.50	MODE	=#1	<pre>//Use input:0=disable, 1=AD-input, 2=Modbus, 3=Freq-in</pre>
9.51	MODBUS_SERVICE	E=#2	//Service input:0=disable, 1=AD-input, 2=Freq-in
9.52	Alarm_out	=#1	//disable=0, enable=1 alarm to output
9.53	alarmLow	=#500	//Low alarm below this value [kg/m3]
9.54	alarmHigh	=#1200	//High alarm above this value [kg/m3]
9.55	Override	=#750	//Default static override value [kg/m3] on alarm
9.56	Override_code	=#0	//O=disable override value, 1=use default override
			//2=use default batch average as override



CLNT0300.dat section 11 example Frequency input 1

11.1 FREQ1_APPLIANCE=#6	//0 =SOLARTRON1, 1=SARASOTA1,
	<pre>//2 =SOLARTON 1/2 CHOICE by digital input,</pre>
	<pre>//3 =SARASOTA 1/2 CHOICE by digital input</pre>
	<pre>//4 =Density Densitometer with span</pre>
	<pre>//5 =Density Standaard with span</pre>
	//6 =Counter for external flowmeter
	//99=disabled
11.2 FREQ1_val_low =#0	//Lowerlimit Value, for FREQ1_APPLIANCE 4-5
11.3 FREQ1_val_high =#1000	//Upperlimit Value, for FREQ1_APPLIANCE 4-5
11.4 FREQ1_low =#0	//Lowerlimit Freq[Hz],(min=0 Hz) FREQ1_APPL 4-5
11.5 FREQ1_high =#1000	//Upperlimit Freq[Hz],(max=5000 Hz) FREQ1_APPL 4-5

7.4 Analog inputs AD card

The AD card has 16 analog inputs.

The input range is bipolar and only the positive range is used, therefore the resolution is 11 bit for 0 - 20mA (range has 2048 positions).

The linearity is ± 1 positions.

Accuracy 0.015% of reading \pm 1bit

The resolution for 4-20 mA is 1638 positions .

This is sufficient for the standard volume correction:

- − The deviation approximately is 0.1% per 1 °C for the temperature correction on the standard volume.
- For a span of 0 100 °C and 4-20 mA this gives: 100 °C / 1638 positions = 0.061 °C / positions The deviation in standard volume per bit then is 0.1%/°C * 0.061 °C / positions = 0.0061% / positions
- The AD input function can be disabled/enabled in the Initialisation file: HSET0300.ufp section
- The specific secondary input can be set in Initialisation file CLNT0300.dat section 9 and 10.
- The signals can be checked on value in the service window: IO
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP Calibration and Verification I/O)
- All inputs can have high/low alarm limitations. In case of an alarm a pre-defined override value can be used (see CLNT0300.dat section 9)
- Adjustable input range 0-20 mA

HSET0300.ufp section 4

```
4.1 AD_Card_Type =#0 //0=disable, 1=AD12 card, 2=AD16 card
4.2 AD_curr_in =#0 //Current inputs disable=0, enable=1
```

CLNT0300.dat section 9: example Temperature proces parameter

```
TEMPERATURE PROCES

9.8 MODE =#1 //Use input:0=disable, 1=AD-input, 2=Modbus

9.9 MODBUS_SERVICE=#0 //Service input:0=disable, 1=AD-input

9.10 Alarm_out =#1 //disable=0, enable=1 alarm to output

9.11 alarmLow =#0 //Low alarm below this value [øC]

9.12 alarmHigh =#100 //High alarm above this value [øC]

9.13 Override =#20 //Default static override value [øC] on alarm

9.14 Override_code =#0 //0=disable override value, 1=use default override

//2=use default batch average as override
```

CLNT0300.dat section 10: example Temperature proces on AD input

```
AD TEMPERATURE PROCES

10.7 val_low =#0 //Lowerlimit proces temperature as [Celsius]

10.8 val_high =#100 //Upperlimit proces temperature as [Celsius]

10.9 curr_low =#4 //Lowerlimit current as [mA] (min. 0mA)

10.10 curr_high=#20 //Upperlimit current as [mA] (max. 20mA)

10.11 tau =#1 //Timeconstant (average) [sec]

10.12 channel =#2 //Channelnr on ad812/816 card ch2/5, 99=disable
```



8 OUTPUT

The output consists of:

- Frequency output MP103 card
- Analog output MP103 card
- Relay outputs MP103 card
- Analog outputs AD card
- Digital outputs AD card
- Modbus communication

8.1 Frequency output MP103 card

Frequency output:

- Maximum output range is software adjustable 1 2000 Hz
- 12V/24V / open-collector selectable by card jumpers
- There is one output value but there are two physical outputs, these can be phase-shifted 90 %180° selectable by card jumper to simulate a turbine output for pulse fidelity and integrity check.

The resolution of the frequency output is max 0.016% of the output value. The resolution mentioned is for a static output value. In practice, the output resolution will be averaged because of the variations in signal. Over a period of time with different output values the resolution will not be an issue.

The most likely frequency output is the proces volumetric flow (default).

- The frequency output function can be disabled/enabled in the Initialisation file: HSET0300.ufp section 3
- The frequency output can be configured in the Initialisation file: CLNT0300.dat section 5
- The signals can be checked on value in the service window: IO.
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP Calibration and Verification I/O)

HSET0300.ufp section 3

3.1 MP_freq_out =#0 //Frequency output 0=disable, 1=enable

CLNT0300.dat section 5



8.2 Analog output MP103 card

The analog output is a pulse width modulated current output, resolution 14 bit.

- The AD output function can be disabled/enabled in the Initialisation file: HSET0300.ufp section 3
- The AD output can be configured in the Initialisation file CLNT0300.dat section 6
- The signals can be checked on value in the service window: IO.
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP Calibration and Verification I/O)

HSET0300.ufp section 3

3.2 MP_curr_out	=#0	//Current	output	0=disable,	1=enable

CLNT0300.dat section 6:

8.3 Relay output MP103 card

There are four relay outputs, normally (no power) open. Open is 0, closed is 1.

Relay No.	Open/Close	Function
0	0	Negative flow, a flow smaller than minus low-flow cut-off
	1	Flow larger than minus low-flow cut-off
1	0	Alarm (system is not reliable):
		- More than 2 channels failure
		- One or more channels failure and flow is out of range for correction
		- System alarm
	1	No alarms(system is reliable)
2	0	Warning (system is still reliable):
		- 1 or 2 channels failure
		- System warning
	1	No warnings
3	0	Positive flow, flow larger than positive low-flow cut-off
	1	No flow (flow rate within limit low-flow cut-off)

- The digital output function can be disabled/enabled in the Initialisation files: HSET0300.UFP section 3
- The signals can be checked on value in the service window: IO.
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP Calibration and Verification I/O)
- More information on warnings and alarms can be found in chapter RUNTIME Windows (alarm window)

HSET0300.ufp section 3

```
3.4 MP_Dig_out =#0 //Digital Outputs 0=disable, 1=NC, 2=NO
```



8.4 Analog outputs AD card

The AD card has two 0-10V analog outputs.

Resolution is 12 bits, linearity $\pm \frac{1}{2}$ bit, settling time 30 microseconds. With additional converters the 0-10V range can be converted into 4-20 mA signals

- The AD output function can be disabled/enabled in the Initialisation file: HSET0300.ufp section 4
- The AD output can be configured in the Initialisation file CLNT0300.dat section 7
- The signals can be checked on value in the service window: IO.
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP Calibration and Verification I/O)

HSET0300.ufp section 4

|--|

CLNT0300.dat

```
_____
 7 <TWO D/A OUTPUTS 0-10 volt, ad812/ad816 card>
 7.1 Out2_mode =#4 //0=DIS 1=flow[m3/h] 2=flow15 3=mass[ton/hr]
 4=dens[kg/m3]
                                                                                                  //5=c_s[m/s] 6=VCF 7=viscosity[10e-6 m2/s]
7.2 Out2_min_volt =#10
7.4 Out2_max_volt =#10
7.5 Out2_max_unit =#610
7.6 Out2_max_unit =#1075
7.6 Out2_max_unit =#1
 7.6 Out2_tau =#10 //Averaging time tau [s]
7.7 Out3_mode =#7 //0=DIS 1=flow[m3/h] 2=flow15 3=mass[ton/hr]
 4=dens[kg/m3]
                                                                                                    //5=c_s[m/s] 6=VCF 7=viscosity[10e-6 m2/s]
 8=dens15[kg/m3]
                                                                                                  //9=Temp[øC] 10=Pres[bar]
                                                                                                 //Minscale U [V], range= 0 - max_volt [V]
//Maxscale U [V], range= min_volt - 10 [V]
 7.8 Out3_min_volt =#0
 7.9 Out3_max_volt =#10
 7.10 Out3 min unit =#0
                                                                                                  //Min. outputvalue in [unity] choice
 7.11 Out3_max_unit =#150 //Max. outputvalue in [unity] choice
  7 10 0..+0
                                   + - - - - -
                                                                         -#60
                                                                                                      time to
```



8.5 Digital outputs AD card

The Ad card has 16 digital outputs, these outputs are connected to the output board PCLD-885: The relays on this board are normally open (no power), single-pole-single-throw(SPST).

Open is 0, closed 1.

When the message is valid the relay is opened

Basic flow measurement WARNING Basic flow measurement ALARM System runtime WARNING System runtime ALARM System set-up WARNING Body temp. on AD input not within set limits for low and high ALARM Density 15°C OUT OF RANGE Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Percentage data filtered OUT of rol low and high ALARM	Relay No.	Message
Basic flow measurement ALARM System runtime WARNING System runtime WARNING System set-up WARNING Body temp. on AD input not within set limits for low and high ALARM Density 15°C OUT OF RANGE Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Density on AD input not within set limits for low and high ALARM Density on AD input not within set limits for low and high ALARM	0	Basic flow measurement WABNING
System runtime WARNING System runtime ALARM System set-up WARNING Body temp. on AD input not within set limits for low and high ALARM Density 15°C OUT OF RANGE Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Perssure on AD input not within set limits for low and high ALARM Persure on AD input not within set limits for low and high ALARM	1	Basic flow measurement ALARM
System runtime ALARM System set-up WARNING Body temp. on AD input not within set limits for low and high ALARM Density 15°C OUT OF RANGE Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Density on input not within set limits for low and high ALARM	2	System runtime WARNING
System set-up WARNING Body temp. on AD input not within set limits for low and high ALARM Density 15°C OUT OF RANGE Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Density on input not within set limits for low and high ALARM	3	System runtime ALARM
Body temp. on AD input not within set limits for low and high ALARM Density 15 °C OUT OF RANGE Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Description input not within set limits for low and high ALARM	4	System set-up WARNING
Density 15 ℃ OUT OF RANGE Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Density on input not within set limits for low and high ALARM	5	Body temp. on AD input not within set limits for low and high ALARM
Corrections on hold due to flow deviations WARNING Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Description on the provided of the set limits for low and high ALARM	6	Density 15℃ OUT OF RANGE
Percentage data filtered OUT OF RANGE Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Description and high act limits for low and high ALARM	7	Corrections on hold due to flow deviations WARNING
Temperature on AD input not within set limits for low and high ALARM Pressure on AD input not within set limits for low and high ALARM Description on the set limits for low and high ALARM	8	Percentage data filtered OUT OF RANGE
Pressure on AD input not within set limits for low and high ALARM	9	Temperature on AD input not within set limits for low and high ALARM
Density on input not within oct limits for low and high ALADM	10	Pressure on AD input not within set limits for low and high ALARM
Density on input not within set limits for low and high ALARM	11	Density on input not within set limits for low and high ALARM
Basic flow measurement, status channel(s): out of range	12	Basic flow measurement, status channel(s): out of range
Basic flow measurement, status channel(s): path failure (mostly due to gas or particles)	13	Basic flow measurement, status channel(s): path failure (mostly due to gas or particles)
Basic flow measurement, status channel(s): deviation in measured sound velocities	14	Basic flow measurement, status channel(s): deviation in measured sound velocities
Basic flow measurement, status channel(s): communication failure	15	Basic flow measurement, status channel(s): communication failure

• The digital output can be disabled/enabled in the Initialisation file: HSET0300.ufp section 4

- The signals can be checked on value in the service window: IO.
- Monitoring is also possible by its calibration program (see Manual: ALTOSONIC V UFP I/O Calibration and Verification)
- Further information on warnings and alarms can be found in chapter of the Alarm window

HSET0300.ufp section 4

4.5 AD_Dig_out =#0 //Digital inputs disable=0, 1=NC, 2=NO



8.6 Modbus communication

The Modbus protocol defines a message structure that controllers, using a master-slave principle, will recognise and use, regardless of the type of networks over which they communicate.

In the communication confiiguraton file COMS0300.DAT the configuration can be changed to make the program compatible with the host system.

The program can act as master and as slave.

Both transmission modes ASCII and RTU are supported.

The data types supported are Boolean, Integer (16 bit), Long Integer (32 bit), Float (32 bit) and double (64 bit).

With these data types all relevant data from the ALTOSONIC V can be retrieved.

The available data is grouped in 9 levels (groups):

- 1. Gross flow measurement
- 2. Standard flow measurement
- 3. Net flow measurement
- 4. Batching, includes normally the levels 1..3
- 5. Analysis, diagnostics, quality
- 6. Control data
- 7. Used settings (corrections on/of etc)
- 8. Master meter configuration (direct connection with duty meter)
- 9. Data measured but not directly used by Altosonic-V, but as an extra service.
- The data available in these fields can be shown real-time on the ALTOSONIC V flow processor screen. See chapter RUNTIME USER WINDOWS.
- For more details on the Modbus protocol and on the available data by Modbus communication see the **ALTOSONIC V ModBus Manual**.



9 Hardware configuration

9.1 MP103 card

There are two possible generations of MP103 cards:

9.1.1 MP103 revision: 3.31300.02

The first generation of MP103 cards, note that this card does not work correct together with the current P233 processor card, only with the previous 486 DX4 100.



9.1.2 MP103 revision: 3.399993.01

The current generation MP103 card



JP9 : To frequency input connector con6 (connected to frequency input bracket)

9.1.3 The signals on the D connectors of the MP103 cards







9.2 RS485/422 card

There are two possible generations of RS485 cards

9.2.1 RS485/422 card: AX4285A

The first generation of RS 485 cards used



***(=KROHNE Altometer setting)

NOTE:

RS485 mode and RS422 mode for COM4 (Modbus) differs in set-up by:

- Jumper JP5 RS485 or RS422

- The external wiring for RS422 and RS485

External wiring AX5285A for Modbus:



The resistors of 120 Ohm must be placed At the ALTOSONIC V wiring terminal



9.2.2 RS485/422 card: PCL-745 S

The current generation RS485/422 card



***(=KROHNE Altometer setting)

NOTE:

JP6 and JP9 are always 422 because the receiver is for both RS485 mode and RS422 mode expected to be enabled for the UFP-Program.

RS485 mode and RS422 mode for COM4 (Modbus) therefore only differs in set up by:

Jumper JP11 not installed (RS485) or installed on 120 (RS422)

The external wiring for RS422 and RS485

External wiring PCL745 for Modbus:





9.3 Printer connections

Printer settings in the UFP can be found in the COMS0300.DAT file in section 2

02 [PRINTER COMMUNICATION SET	UP]	
02.01 PRINTER_COMPORT	c=#1	//1, 2, 3, 4
02.02 PRINTER_WORD_LENGTH	c=#7	//7, 8
02.03 PRINTER_PARITY	c=#2	//0=disabled, 1=odd, 2=even
02.04 PRINTER_STOP_BITS	c=#1	//1, 2
02.05 PRINTER_BAUDBATE	c=#9600	//38400, 19200, 9600, 4800, 2400, 1800
02.06 PRINTER_DTR_POLARITY	c=#1	//1200, 600, 300, 200, 150, 134.5, 110, 75
02.07 PRINTER_RTS_POLARITY	c=#1	//0=pos, 1=neg
02.08 PRINTER_TIMEOUT	c=#5000	//Timeout [ms] on acknowledges etc.
02.09 PRINTER_TIMEOUT_MANAGE	c=#30	//Timeout [s] for print management switch





9.3.2 OKI280 Elite + MFX_4 SDI module + UFP





10 Extended Operations

The following extended operation options are possible:

- External Flowmeter setup (master duty)
- Base Sediment and Water content
- Other Standard Volume standards than API2540
- Extra batching functions
- Simulated Frequency on failure
- Meter factor adjustment through Modbus
- Reynolds Warning function

10.1 External Flow meter (master duty)

The UFP-V has the possibility to act as a Master Duty system. The duty meter is the external flow meter input. An online comparison is possible over the volume preferred. A good comparison is only made by comparing the standard volumes of both systems.

Under F9 Controls, F3 Extern the below window can be found. In this window the following actions can be done (also possible by Modbus input)

K factor :	enter to change 0.4997689 puls/liter
Total pulses :	2458
Total proces :	4.91924 [m3]
Total stand. :	5.04362 [m3]
Total mass :	3.27836 [t]
Flow rate	: 1800,94 [m3/h]
Temperature	: 0.000 [°C]
Pressure	: 0.000 [bar]
UCF	: 1.0216
Diff to ASU	: -0.0309 %
New Kfactor	0.4995[144 puls/liter
	Change mode at always <enter> : Set param./value-change <arrow down="" up=""> : Scroll/Change value <arrow left="" right="">: Increase step value <prov> : Start prove (by reset totals & errors <pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre></prov></arrow></arrow></enter>
Serial#:232574100	1 Window :EXT-FLOWMETER Batch :RESET <u>KROHNE</u>
Tag #:51-FT-002	Warrings:1 Printer:CHECK Altonutter
Version:03.00.50.(01 Alarms:2 HESET (C) 2008
Data :exe00000-1	18421-03601-26972 Mamply NORMAL 13:45 ♥

- The used K factor can be inputted
- Comparison tests can be started and stopped
- A new found K factor after a proving can be committed

Note: Do not forget to save the configuration after a change, only the saved configuration values are used.

The necessary inputs for the comparison are:

- The flow signal from the external flow meter must be a pulse input for the UFP-V. An optional
 pulse counter on the MP103 card reads in the number of pulses. The K factor (pulse/liter) converts
 the counted pulses to a measured proces external volumetric total
- Recommend is to use the temperature and pressure at external flow meter conditions for calculation of the standard volume. If the meter is close enough to the ALTOSONIC V system the



proces temperature and pressure can be copied to the external temperature and pressure but note that 1° C difference causes about 0.1% error, and 1 bar difference causes about 0.01% error.

Practice shows that both repeatability and linearity improve when comparing calculated standard values.

It is possible to compare the proces volumetric total of the external flow meter with the proces volumetric total of the UFP-V but then the ALTOSONIC V must also be set as only calculating proces volume.

Description of the controls in this window:

Function keys do the controls of this window, therefore it is only possible to go back to the Main window.

F1	: Go back to Main window
F2 (or ENTER)	: Disable/enable value change of the K factor manually
F3 (or arrow up)	: If value change is enabled (F2) increase value
F4 (or arrow down)	: If value change is enabled (F2) decrease value
F5 (or <arrow left="">)</arrow>	: If value change is enabled F2) increase step value of change (F3,F4)
F6 (or <arrow right="">)</arrow>	: If value change is enabled (F2) decrease step value of change (F3,F4)
F7 (or <prov>)</prov>	: Start proving, reset of totals and errors on both UFP-V and External
F8 (or <new>)</new>	: Install found NEW K factor and start prove as described in F7
F10 (or < B>)	: Save configuration if K factor is manually installed

Note: Starting a prove involves resetting of resetable totalisers and occurred alarms.

10.2 Base Sediment and water (BSW)

The Base Sediment and Water (BSW) is inputted by AD input or Modbus as a percentage of the volume flow.

The actual value of the BS&W percentage is provided through modbus: F7591 or alternatively on an AD input channel if the modbus connection times out for more than 30 seconds. It is off course also possible to input the value only by the AD-input.

The nett totalisers are calculated by subtracting the BSW percentage from the gross flow (proces, standard, mass) and totalising this into separate totalisers.

10.3 Other Standard Volume standards than API2540

Other then API2540 volume correction standards are implemented.

- ASTM-IP (D1250, 1953)
 - API 11.2.1M can be used to calculate the compressibility correction.
- LPG (GPA) TP25
 - API 11.2.2M is used to calculate the compressibility correction.

• ULHC (Unstable Liquid Hydro Carbons), specially developed for the Russian

Depending on the standard choosen, under F9, F2 the configuration can be made



CLNT0300.DAT configuration file excerpt:

15 <standard contr<br="">Can be used to change to volume correction as opported NOTE: For both D2540 and the component</standard>	OL> o the old ASTM-IP (table 53/54, D1250) or LPG standard osed to the (default) API (D2540, 54C) standard. nd D1250 the API 11.2.1M equation is used to calculate ressability correction.
1E 1 Ctandard control	
15.1 Standard_control	C = #0 // 0 = API (D2540, Table 54C)
	// 1=ASTM-IP (D1250, 1953)
	// 2=LPG (GPA)
	// 3=ULHC (Unstable Liquid Hydro Carbons)
	// with online changeable standards BLOCKED:
	// 10=as 0 but blocked
	// 11-as 1 but blocked
	// 10. as 0 but blocked
	// IZ=as z but blocked
	// 13=as 3 but blocked

Note that there is an option to select the desired standard on-line. Due to custody transfer regulations that differ per country, it is also possible to block that possibility.

10.3.1 F9, F8 Choose standard volume calculation standard

CHOOSE API/ASTM-IP/LPG or U	JLHC STANDARD		
CHOOSE API/ASTM-IP/LPG or U API D2540 (DIL/DIL-) ASTM-IP D1250 (1953 LPG (GPA TP-25, API ULHC (Unstable Liqu:	JLHC STANDARD PRODUCTS) EDITION) 11.2.2M) id HydroCarbons)		
	<set> <arrow up∕d<br=""></arrow></set>	: Select own> : Scroll : Save so	standard elected standard
Serial#:2325741001 H: Tag #:51-FT-002 Ha Version:03.00.50.01 A Data :exe00000-18421-03603	indow :STANDARDS arnings: 1 larms : 2 L-26972	Batch : NC Printer: OF 4task : NC DUMMY : <mark>N</mark>	N <u>KROHNE</u> F Altometer N (C) 2008 <mark>DRMAL</mark> 15:19 ♥
MAIN SET UP DO F1 F2 F3 F	WN 4 F5 F6	F7 F8	F9 F10

These options and values can also be inputted by Modbus

Note that this window control (and Modbus control) can be blocked from normal use, as described in the previous paragraph.



10.3.2 F2 ASTM-IP window

If the standard volume correction is set to ASTM-IP (1953 edition)

ASTM-IP (1953) STANDARD	VOLUME/MAS	SS CONFIGURATI	ON DATA		
Calculation :	d Isabled Standard V Mass Measl	Jolume∕Mass By Jrement by Pro	ASTM STAN CES DENSIT	DARD Y	
Temperature standard:	15.000 C	•C1			
Density standard by :	FILL IN MA CALCULATED ON AD/MODE	NUALLY FROM DENSITO BUS INPUT	Meter dens	ITY	
Density standard :	700.00 ti	<g n3]<br="">Change mode a (Enter)</g>	t always : Set	param./4	value-change
		<pre><arrow <arrow="" <i="" dow="" left="" n="" p="" r="" up=""> <1,2, </arrow></pre>	n> : Ser ight>: Inc 3> : nor : Sav	oll/Chang rease ste mal, °AP) e configu	ge value ep value [60, \$G uration
Serial#:2325741001 Tag #:51-FT-002 Version:03.00.50.01 Data :exe00000-18421-6	Window Warnings Alarms)3601-26972	:ASTM/IP-SETT ;:1 :2 ?	INGBatch Printer Ltask DUMMY	: NON : OFF : NON : <mark>NORMAL</mark>	<u>KROHNE</u> Altometer (C) 2008 15:08 ♥
MAIN ENTER UP F1 F2 F3	DOWN F4	LEFT RIGHT F5 F6	INP1 F7	INP2 F8	INP3 SAVE F9 F10

Calculation options : same as options under API2540 Temperature standard : same as options under API2540 Density standard by : same as options under API2540 Density standard value : Input value, same as under API2540

There is no distribution of fluid types in the ASTM-IP (D1250, 1953).

The compressibility is calculated according to API 11.2.1M, when needed pressure inputs are enabled.

These options and values can also be inputted by Modbus



10.3.3 F2 LPG window

If the standard volume correction is set to LPG (GPA TP25)

LPG (API) STANDARD VOLUME/M	ASS CONFIGURATION DATA
Calculation : DIS	ABLED
STAI	NDARD VOLUME∕MASS BY LPG STANDARD
MAS	S MEASUREMENT BY PROCES DENSITY
Temperature standard: 🕨 👖	5.000 [*C]
Density standard by : FIL	L IN MANUALLY
CAL	CULATED FROM DENSITOMETER DENSITY
ON	AD/MODBUS INPUT
Equilibrium Pres. by: P <mark>FIL</mark>	L IN MANUALLY
ON	MODBUS INPUT
Equilibrium pressure: D	<mark>4.000</mark> [bar] (Gauge)
Density standard : 🕨 5	50.00 [kg/m3]
	Change mode at always <enter> < Set param./value-change <arrow down="" up=""> < Scroll/Change value <arrow left="" right="">: Increase step value <i n="" p=""> <1,2,3> < normal, *API 60, SG < Save configuration</i></arrow></arrow></enter>
Serial#:2325741001 W	indow :LPG SETTINGS Batch :NON <u>KROHNE</u>
Tag #:51-FT-002 W	arnings: 1 Printer:CHECK Altometer
Version:03.00.50.01 A	larms :3 ↓task :NON (C) 2008
Data :exe00000-18421-0360	1-26972 DUMMY : <mark>NORMAL</mark> 15:24 ♥
MAIN ENTER UP DO	JWN LEFT RIGHT INP1 INP2 INP3 SAVE
F1 F2 F3 F	4 F5 F6 F7 F8 F9 F10

Calculation options Temperature standard Density standard by Equilibrium Pres. By Equilibrium Pres. (value) Density standard value : same as options under API2540
: same as options under API2540
: same as options under API2540
: Fill Manually or Modbus input
: Available if chosen to fill value Manually (gauge pressure)
: Input value, same as under API2540

The compressibility is calculated according to API 11.2.2M

These options and values can also be inputted by Modbus



10.3.4 F2 ULHC window

If the standard volume correction is set to ULHC

ULHC STANDARD VOLUME/M	ASS CONFIGU	RATION DATA			
Calculation :	D I SABLED STANDARD	JOLUME∕MASS BY U	LHC STANI	DARD	
Temperature standard:	▶ 20.000 c	°C1			
Density standard by :	FILL IN MA CALCULATEI ON AD/MODI	ANUALLY D FROM DENSITOME BUS INPUT	TER DENS	ITY	
Maximum error by:	FILL IN MA	ANUALLY INPUT			
Maximum error:	• 0.100 C	kg/m3]			
Density standard :	705.98 c	kg∕m3]			
		Change mode at <enter> <arrow down="" up=""> <arrow left="" rig<br=""></arrow></arrow></enter>	always : Set : Ser : Ser ;ht>: Inc : Sav	param./(pll/Chang rease ste e configu	value-change ge value ep value uration
Serial#:2325741001 Tag #:51-FT-002 Version:03.00.50.01 Data :exe00000-18421	Window Warnings Alarms -03601-26972	:ULHC SETTINGS 5:1 :4 ?	Batch Printer Ltask DUMMY	: NON : OFF : NON : <mark>NORMAL</mark>	KROHNE Altometer (C) 2008 15:38 ♥
MAIN ENTER UP F1 F2 F3	DOWN F4	LEFT RIGHT F5 F6	F7	F8	F9 F10

Calculation options Temperature standard Density standard by Maximum error by Maximum error (value) Density standard value No direct mass calculation available
same as options under API2540
same as options under API2540
Options are: "Fill Manually" or "Modbus input"
Maximum allowed error in iterative proces.
Input value, same as under API2540

These options and values can also be inputted by Modbus



10.4 Extra batching options

10.4.1 Air buoyancy correction

If this option is enabled, at the end of the batch the Air buoyancy correction is calculated and possible printed on the ticket (registers 527...529).

CLNT0300.DAT Excerpt

19 [WEIGHT OF STANDARD (batch) VOLUME	IN AIR (AirBuoyancy correction)]
The weight (in air) is calculated W.I.A. = Volume(15) * (Densi [kg] = [m3] * ([kg/m3] Where the * Factor + Offset pa the W.I.A. Ie. a factor of 0.001	as follows: ty(15) + AirBuoy + [kg/m3]) rt is to be able to will give the W.I.	rancy) * Factor + Offset o influence the unit of A. in metric tons [t].
19.01 WeightInAir 19.02 AirBuoyancy 19.03 Factor 19.04 Offset	=#0 =#-1.10 =#0.001 =#0.000	//[01] 0=OFF, 1=ON //[-100100] Air Buoyancy number [kg/m3] //19.3 and 19.4 are for calculating the desired //unit by utilising: Y = X * Factor + Offset

10.4.2 Batching without printer

The option to use batching without use of the printer. The tickets are saved in the UFP. If a printer is connected, the tickets will be printed. If there is no printer available, no alarm or window swapping will take place.

12.05 Modbus_control	c=#2	 //0=No Control batching through Modbus //1=Control batching through Modbus //2=as 0 with no printer alarm //3=as 1 with no printer alarm 	
----------------------	------	---	--



10.4.3 Measurement alarms batch validation error values input

Depending on the application the batch validation error values can be changed. For example if the temperature input can not differ more from the measured value than for example 100 °C, than the validation error on that input can be changed to 10% of 25% (250 °C difference). Also the weighing method as described in chapter 6 can be changed.

CLNT0300.DAT excerpt

21 [BATCH VALIDITY PERCENTAGES]	
The following percentages [0100] are used (if calculate if the batch has an acceptable error v (Worst case batch volume error calculation in r batch volume for all occured errors.) See the Altosonic-V Operator manual for a mon the calculation being utilized for this.	batching is enabled) to olume. elation to the total re detailed explanation of
Discuss/verify the batch error percentage (21.1	6) with you local DTI!
 21.01 Weight (%) for Temperture Body 21.02 Weight (%) for Temperture Process 21.03 Weight (%) for Temperture External 21.04 Weight (%) for Temperture Density 21.05 Weight (%) for Pressure Process 21.06 Weight (%) for Pressure External 21.07 Weight (%) for Pressure Density 21.08 Weight (%) for Density 21.09 Weight (%) for Density Standard 21.10 Weight (%) for 1-4 channels down 21.12 Weight (%) for API group mismatch 21.14 Weight (%) for System Alarms 21.15 Weight (%) for allowed batch error 21.17 Method of weighing 	c=#1.00 c=#25.00 c=#25.00 c=#25.00 c=#2.50 c=#2.50 c=#100.00 c=#100.00 c=#100.00 c=#100.00 c=#100.00 c=#10.00 c=#3.50 c=#0.06 c=#2 //1=Weighing on Max Flow only //2=Weighing on Actual Flow when // possible



10.4.4 Guard digital contacts

The GuardDigitalContacts feature (ab)uses the start and stop contacts (Digital Input 3 and 4 from the MP-103 card, so this only works when NOT in calibration mode) to guard one or two digital inputs (pe. Valve states) from batch-start untill batch-stop. (So only works when batching is on) and reports any detected change as an error on the BOL. If 20.2 and 20.3 are 0, Boolean 2076 is checked at batch end and if it is '0' an ERROR is reported, if it is '1' an OK status is reported.

CInt0300.dat

20.01 GuardDigitalContacts	=#0 _#0	//[01] 0=OFF, 1=ON
20.02 CheckContact_3 (Stri)	=#0 _#0	/[0.1] 0=011, 1=0N, Guard DI3
	=#0	//[01] 0=0FF, 1=0N, Guard D14 //Text can be 20 characters, and also
20.04 System status OK text	=#OK	//Status OK text.
20.05 system status ERROR text	=#NOT@OK	//Status ERROR text

See also chapter 6.3 register 210 for printing message to batch ticket.



10.5 Simulated Frequency on failure

If the meter is installed downstream of a separator that can lead to total meter failure due to air/liquid mix the following function is made to avoid Platform shutdown on meter failure due to gas/liquid mixture.

Technic & Specification BC00-32-173:

1.0 Effects of water in oil on USM measurements

1.1 Concern has been raised surrounding the effects of varying levels of water in crude oil that may be presented to the liquid ultrasonic flow meters that are proposed for fiscal custody transfer on BP Miller Platform. Levels of water below 5% are considered to be within the USM manufacturer's level of uncertainty. The commingled flow of oil and water is homogeneously mixed by the LP pumps and normal water content does not exceed 1%. At a certain level of water in oil above 5% (yet to be confirmed) the USM will attenuate or scatter the ultrasonic signals. The overall effect of this will result in all five paths of the ultra sonic flow meter being lost and no actual flow measurement being recorded through the metering station. The frequency and duration of these events are historically 1 hour every two weeks and the levels of water in the crude may vary between 5% and 40%.

1.2 These produced water plant upsets introduce a period of instability when significant quantities of produced water can be exported to the pipeline although steps are taken immediately by operations to limit the amount of water being exported. The ultrasonic flow meter will continue to provide accurate information even after four of the acoustic paths have attenuated. Only after the fifth acoustic path attenuates will the meter cease to measure.

1.3 When the ultrasonic meter stops measuring it is proposed to provide information from the USM, the flow computer and the density analyser that will allow a mismeasurement calculation to be carried out. The Krohne flow computer will generate virtual flow pulses that reflect the last actual flow rate measured. This information will be time stamped and recorded in a separate trend analysis file together with the density trends. Once the USM re-establishes an actual flow rate these virtual flow pulses will stop and the file time stamped. It will then be possible to estimate the amount of oil exported during these upset periods using a mismeasurement calculation.

1.4 In order to limit the discontinuity during the transient periods of loss of measurement the following proposals are suggested:

- a. On loss of all five probe signals the Krohne flow computer will produce virtual flow pulses to the SGC flow computer and will not indicate loss of signal for a period of I minute.
- b. If, during the I minute period, the flow signals are re-established then real flow pulses will be reinstated and the SGC flow computer will NOT record a m ismeasu reme nt.
- c. If, after I minute, the flow signals are NOT re-instated then the SGC flow computer will start to record a mismeasurement.
- d. The end of the mismeasurement period will be flagged by the Krohne flow computer after real pulses have been re-instated for at least 10 seconds.

CLNT0300.DAT excerpt:

16 [SIMULATED FREQUENCY (PULSE TRAIN) OUTPUT FOR FLOW]					
Upon Velocity Of Sound (VOS) failure on all channels, the UFP will transmit simulated pulses (flow) on the first frequency output of the MP103 card. Note that the MP103 should be configured to output the Gross Flow or the Standard Flow (Section 5) for this feature to work properly.					
For a full technical specification of this feature see the AMEC document: BC00-32-173-issue-0002					
16.01 SimulatedFrequency 16.02 SimFreqTimer1 16.03 SimFreqTimer2 16.04 SimFreqLowVOS 16.05 SimFreqHighVOS 16.06 TotalisersUpdate 16.07 SimFlowOnPath	N =#1 =#60 =#30 =#1.0 =#5000.0 =#0 =#0	//[01] 0=OFF, 1=ON //time before alarm [1300 s] //data validation timer [15150 s] //VOS low limit [1.05000.0 m/s] //VOS high limit [1.05000.0 m/s] //[01] 0=OFF,1=ON update totals on fail //[01] 0=OFF,1=ON SimFlow on path fail			



10.6 Meter factor adjustment through Modbus

In a master duty configuration the master checks the meter factor of the Duty meter. This option provides access to the meter factor by Modbus communication.

CLNT0300.DAT excerpt

17 [METER FACTORS]			
Possibility to set the meter directions. The meterfacto respectively	r factor (MF) fo rs can be set c	r positive and reverse flow n modbus addresses F7524 and F7525	
17.01 MeterFactorsOn	N=#1	//[01] 0=OFF, 1=ON	

Note that the reverse direction Meter Factor can only be accessed if the Reynolds Correction is also enabled in reverse direction (REYN0300.UFS, see parameter 2.1 and section 4)

10.7 Reynolds Warning function

The transition area between laminar and turbulent flow can be set up with an alarm system as this is an area that needs attention for its influence on accuracy on ultrasonic flowmeters.

18 [WARNING REYNOLDS NUMBER (Re/1000)]

 18.01 Reynolds_warning
 c=#1

 18.02 Warning_on_number
 c=#1.25

 18.03 Warning_off_number
 c=#3.5

//[0..1] 0=OFF, 1=ON //ON if > than Reynolds number [Re/1000] //OFF if > than Reynolds number [Re/1000]

10.8 Window changes due to extended operations

This leads to some changes in the normal windows of the UFP



Above is the full operations Main Window.

Extra in this window is :

- "Ext Flow Meter" conditions (T, P, D) under CONDITIONS A separate temperature and pressure input are provided in the software under the name Temp Proving and Pressure Proving. The density under the given temperature and pressure are calculated is the density under standard conditions is available (through calculation or input)
- External Flow Meter: Flow, Totaliser, Error (deviation)% There is a on-line continuous comparison between the master and the duty. The comparison is controlled under F9 Controls, F3 Extern.
- Nett volume totalisers due to Base Sediment and Water % subtraction.



10.8.2 F2 Alarm Window changes due to extended operations

CHANNEL ERRORS							
	oor[s] path	[s]	dev.c[s] commu[s]	comfa[s]		
Channel 5:							
Channel 4:							
Channel 3:							
Channel 2:							
Channel 1:							
INPUT ALARM	Sif	ma	nual[s]	measure[s]	CALCULATION	[s]	
Temperature	Body		0.00	0.00	API group mismatch:	0.00	
Temperature	Proces		0.00	0.00			
Temperature	Proving		0.00	0.00	GENERAL FLOW	[s]	
Temperature	Densitometer		0.00	0.00	1-4 channels down :	0.00	
Pressure	Proces	:x	4560.14	0.00	All channels down :	427.00	
Pressure	Proving		0.00	0.00			
Pressure	Densitometer		0.00	0.00	REAL PROFILE	[s]	
Density	Densitoad-inp		0.00	0.00	Out of range :	0.00	
Density	Standard		0.00	0.00			
Viscosity	Kinematic		0.00	0.00	CORRECTION WARNINGS	[s]	
Base Sedime	nt and Water	:×	56.00	0.00	Correction on hold:		
SYSTEM ERRORS OCCURRED					Real-P on hold :		
	08				Reynolds limit :)	< 0.31	
9999 x Err 08 A:Measure Program CRC corrupt							
Serial#:2325741001 Window :ALARMS Batch :RESET KROHNE							
Tag #:51-FT-002 Warnings:1					Printer: CHECK	Altometer	
Version:U3.UU.5U.UI Alarms :2							
MAIN ALARMS CORRECT STATIST TREND PROFILE BATCH CONTROLS SEDUCTOR							
F1 F2	F3	F4				ES SERVICE	

Above is the full operations Alarm Window.

Extra in this window is :

- Input Alarm Temperature Proving (also in basic operations visible)
- Input Alarm Pressure Proving (also in basic operations visible)
- Input Alarm Base Sediment and water
- The Reynolds Warning function (Reynolds limit) active, yellow cross X



10.8.3 F3 Correct Window changes due to extended operations

BEAL-P Channel 5: 938.12 Real-p update[s]: 179 Channel 4: 946.09 Channel 3: 964.48 Channel 2: 947.99 Channel 1: 936.13 v[m/s] : 12.97								
CORRECTION reynolds	body-expansion							
RE-velo : 0	Swir1 [%]: -0.518	Temp.body[°C]: 20.58						
Visc[cSt]: 0.00	Skewness [%]: 0.394	кь :> 1.0000						
AL : 1.799	Deviate-dA : 0.000	Кыр :• 1.0000						
BL : # 1.315	Deviate-dB : 0.000	Base Sediment and Water						
RE-a&b :x 338000	Ks : 1.0000	BS&W [%] :x 0.0000						
Visc-a&b : 11.08		Meter factor(s)						
Kr :> 1.0010		Forward : 1.0000						
Dev ab[%]: 8.92		Reverse : 1.0000						
STANDARD VOLUME CORRECT CONDITIONS temperatur I°C13 Proces : 21.3 Standard : 15.0 Densito ad-inp: 20.1 Ext flow meter: 0.0	IONS density e pressure density Bx 6.10 695.01 0 0.00 700.00 6 -52.94 700.08 0 0.00 713.08	CORRECTION FACTORS To Stdf*C1 Ctl Cpl Proces 0.9920 1.0009 Standard: 1.0000 1.0000 Densito: 1.0000 1.0000 External: 1.0187 1.0000						
Serial#:2325741001 Window :CORRECTIONS Batch : RESET KROHNE								
lag #:51-FI-UU2 Warnings:1 Printer:OFF Altom Version:03.00.50.01 Alarms:2 Stask :BESET (C)								
Data :exe00000-18421-03601-26972 DUMMY : NORMAL 14:16 💙								
MAIN ALARMS CORRECT STATIST TREND PROFILE BATCH CONTROLS SERVICE								

Above is the full operations Correction Window. Extra in this window is :

- Base Sediment and water content [%]
- Meter factor values forward and reverse (adjustment through Modbus only)
 "Ext Flow Meter" conditions (T, P, D) under CONDITIONS
- "Ext Flow Meter" correction factors Ctl and Cpl under CORRECTION FACTORS



Australia

KROHNE Australia Pty Ltd. Unit 19 No. 9, Hudson Ave. Castle Hill 2154, NSW TEL.: +61(0)2-98948711 FAX: +61(0)2-98994855 e-mail: krohne@krohne.com.au

Austria

KROHNE Ges.m.b.H. Wagramerstr. 81 Donauzentrum A-1220 Wien TEL.: +43(0)1-2 03 45 32 FAX: +43(0)1-2 03 47 78 e-mail: kaut@via.at

Belgium

KROHNE Belgium N.V. Brusselstraat 320 B-1702 Groot Bijgaarden TEL.: +32(0)2-4 66 00 10 FAX: +32(0)2-4 66 08 00 e-mail: krohne@krohne.be

Brazil

KROHNE Conaut Controles Automaticos Ltda. Estrada Das Águas Espraiadas, 230 C.P: 56 06835 - 080 EMBU - SP TEL.: +55(0)11-4785-2700 FAX: +55(0)11-4785-2768 e-mail: conaut@conaut.com.br

China

KROHNE Measurement Instruments Co. Ltd. Room 7E, Yi Dian Mansion 746 Zhao Jia Bang Road Shanghai 200030 TEL.: +86(0)21-64677163 FAX: +86(0)21-64677166 Cellphone: +86(0)139 1885890 e-mail: ksh@ihw.com.cn

CIS

Kanex KROHNE Engineering AG Business-Centre Planeta, Office 403 ul. Marxistskaja 3 109147 Moscow/Russia TEL.: +7(0)095-9117165 FAX: +7(0)095-9117231 e-mail: krohne@dol.ru

Czech Republic

KROHNE CZ, spol. s r.o. Dráz?ní 7 62700 Brno TEL.: +42(0)5-45513340 / 341 FAX: +42(0)5-45513339 e-mail: brno@krohne.cz

France KROHNE S.A. Usine des Ors B.P. 98 F-26 103 Romans Cedex TEL.: +33(0)4-75 05 44 00 FAX: +33(0)4-75 05 00 48

e-mail: info@krohne.fr

Germany KROHNE Messtechnik GmbH & Co. KG Ludwig-Krohne-Straße D-47058 Duisburg TEL.: +49(0)203-301-0 FAX: +49(0)203-301 389 e-mail: krohne@krohne.de

India

KROHNE Marshall Ltd. A-34/35, MIDC Industrial Estate; 'H'-Block, Pimpri Pune 411018 TEL.: +91(0)20 -747 01 21 TEL.: +91(0)20 -747 01 71 FAX: +91(0)20 -747 70 49 e-mail: ksales@forbesmarshall.com

Italy KROHNE Italia Srl Via V. Monti 75 I-20145 Milano TEL.: +39(0)2-4 30 06 61 FAX: +39(0)2-43 00 66 66 e-mail: info@krohne.it

Korea Hankuk KROHNE 2 F 599-1 Banghwa-2-Dong Kangseo-Ku Seoul TEL.: +82(0)2665-85 23-4 FAX: +82(0)2665-85 25 e-mail: flowtech@unitel.co.kr

Netherlands KROHNE Altometer Kerkeplaat 12 NL-3313 LC Dordrecht TEL.: +31(0)78-6306300 FAX: +31(0)78-6306390 e-mail: postmaster@krohne-altometer.nl

KROHNE Persenaire B.V. Kerkeplaat 12 NL-3313 LC Dordrecht TEL.: +31(0)78-6306200 FAX: +31(0)78-6306234 Service Direkt: +31(0)78-6306222 e-mail: krohnepe@worldonline.nl

Norway Krohne Instrumentation A.S.

Ekholtveien 114 NO-1526 Moss P.O. Box 2178, NO-1521 Moss TEL.: +47(0)69-264860 FAX: +47(0)69-267333 e-mail: postmaster@krohne.no Internet: www.krohne.no

South Africa KROHNE Pty. Ltd.

163 New Road Hulway House Ext. 13 Midrand TEL.: +27(0)11-315-2685 FAX: +27(0)11-805-0531 e-mail: midrand@krohne.co.za

Spain

I.I. KROHNE Iberia, S.r.L. Poligono Industrial Alcalá I Calle El Escorial, Nave 206 E-28805 Alcalá de Henares -Madrid TEL.: +34(9)1-8 83 21 52 FAX: +34(9)1-8 83 48 54 e-mail: krohne@krohne.es

Switzerland

KROHNE AG Uferstr. 90 CH-4019 Basel TEL.: +41(0)61-638 30 30 FAX: +41(0)61-638 30 40 e-mail: info@krohne.ch

United Kingdom

KROHNE Ltd. **Butherford Drive** Park Farm Industrial Estate Wellingborough, Northants NN8 6AE, UK TEL.: +44(0)19 33-408 500 FAX: +44(0)19 33-408 501 e-mail: info@krohne.co.uk

USA

KROHNE Inc. 7 Dearborn Road Peabody, MA 01960 TEL.: +1-978 535-60 60 FAX: +1-978 535-17 20 e-mail: krohne@krohne.com

Overseas Representatives

Algeria Japan Argentina Bulgaria Jordan Kuwait Camaroon Marocco Mauritius Canada Mexico New Zealand Pakistan Columbia Croatia Denmark Poland Ecuador Portugal Saudi Arabia Egypt Finland Senegal French Antilles Singapore Greece Slovakia Guinea Slovenia Hong Kong Sweden Hungary Indonesia Taiwan Thailand Ivory Coast Turkey Tunesia Ireland Venezuela Yugoslavia

Other Countries:

Chile

Iran

Israel

KROHNE Messtechnik GmbH & Co. KG Ludwig-Krohne-Str D-47058 Duisburg TEL.: +49(0)203-301 309 FAX: +49(0)203-301 389 e-mail: export@krohne.de