



KELLER

***ARC-1 Cellular data communication protocol
(GSM/UMTS/LTE)***

Client: Keller AG für Druckmesstechnik
Document type: Documentation
Titel: Cellular data communication protocol
Product: ARC-1
File name: ARC-1 Cellular data communication protocol v1.00a
Version: 1.00a
Place, Date: Winterthur, 24.05.2018



TABLE OF CONTENTS

| | | |
|-------|---|----|
| 1 | Commands..... | 1 |
| 1.1 | Syntax (General structure) | 1 |
| 1.1.1 | Example how the structure will look like (configuration): | 1 |
| 1.1.2 | Limitation..... | 1 |
| 1.2 | Command table for E-Mail / FTP | 2 |
| 1.2.1 | General Content | 2 |
| 1.2.2 | Configuration..... | 5 |
| 1.2.3 | Execute specific functions of the ARC-1 via remote access | 12 |
| 2 | Record EEPROM (Memory-Map)..... | 13 |
| 2.1 | Header | 13 |
| 2.2 | Data packet..... | 14 |
| 3 | Overview message type | 15 |
| 4 | SMS..... | 16 |
| 4.1 | Description of the data format..... | 16 |
| 4.2 | General Settings | 17 |
| 4.2.1 | “Measure” | 17 |
| 4.2.2 | “Info” | 18 |
| 4.2.3 | “Alarm” | 18 |
| 4.2.4 | “Check” | 19 |
| 5 | FTP / E-Mail | 20 |
| 5.1 | Description of the data format / storage | 20 |
| 5.1.1 | FTP (recommended) | 20 |
| 5.1.2 | E-Mail..... | 20 |
| 5.2 | General Settings (used for these examples)..... | 21 |
| 5.2.1 | Communication | 21 |
| 5.2.2 | Channels | 21 |
| 5.3 | Measure “#F/a” / “#F/e” | 22 |
| 5.3.1 | With “Record function” in Base64 “#F/e” (recommended)..... | 22 |
| 5.3.2 | In plain text “#F/a” (not recommended)..... | 23 |
| 5.4 | Info “#F/b” | 24 |
| 5.5 | Alarm “#F/c” | 25 |
| 5.6 | Check “#F/d” / “#F/f” / “#F/g” | 26 |
| 5.6.1 | Request missing Record data | 26 |



| | | |
|-------|---|----|
| 5.6.2 | Get "Error" Report..... | 28 |
| 6 | Device type overview | 30 |
| 7 | Decoding Base64 | 33 |
| 7.1 | Example Measurement file (record activated):..... | 33 |
| 7.2 | Converted BASE64 (green) to Decimal (red) code: | 33 |
| 7.3 | Interpretation:..... | 33 |
| 8 | CRC16 | 34 |
| 9 | Revision History | 35 |



1 COMMANDS

The ARC-1 can be controlled / configured via the cellular interface using the ARC-1 specific commands.

1.1 Syntax (General structure)

<command> / <variable name1> = [<+,->] <variable value 1> [/] [<variable name 2>] [=] [[<+,->]] [<variable value 2>]

| Characters | Description |
|------------------|--|
| # | start pattern of each command |
| <command> | Defines the superordinate function from the commando table (one letter) / 0...9, a...z, A...Z |
| / | delimiters of different data containers |
| <variable name> | Defines the subordinated command (one letter) / 0...9, a...z, A...Z |
| = | Separator for the associated value of the subordinated command |
| [<+,->] | sign of the variable value (not required for strings) |
| <variable value> | value or string of <variable name> / "space" to "z" (32 ... 122) |

1.1.1 Example how the structure will look like (configuration):

```
#F/d=0#T/s=581094554/p=18.05.31,17:08:58+08#M/a=-0.9611795+0.0002412+26.698974+0.9614199+28.260000+0.0005353+0.0003824/c=+1+1/d=-0.9611795+0.0002412+OFL+OFL+26.698974+OFL+0.9614199+28.260000+0.0005353+0.0003824#I/n=5/s=24/b=96/e=9.20/f=18.12/h=41/v=+3.902#a/a=gprs.swisscom.ch/b=gprs/c=gprs/d=000.000.000.000/e=ARC-1/f=gsm_103@gsmdata.ch/g=XXXXXX/h=datamaner_103@gsmdata.ch/i=XXXXXX/j=pop.mail.ch/k=995/l=smtp.mail.ch/m=465/n=gsm_103@gsmdata.ch#b/a=datamaner_103@gsmdata.ch/b=datamaner_103@gsmdata.ch/c=datamaner_103@gsmdata.ch/g=Keller/j=/k=/m=+41791234567/n=+41791234567/o=+41791234567/q=+41794999000/r=Keller Entwicklung /s=+41774293910/t=ARC 3G neu/u=MEASURE message/v=ALARM message/w=CHECK message/0=8.7475439/1=47.4984244/2=450.000/3=8.746532 /4=47.500267/5=0.0000000#c/a=581097900/b=581094300/c=581162400/d=581155200/e=553182000/g=300/h=300/i=86400/j=86400/k=86400/m=211/n=0/o=1/p=3/q=12/r=1/s=1/t=2/v=6/w=4/x=8/y=13/z=40/0=0/1=3/2=0/3=0/4=3/5=12/6=5/7=0/8=2/9=0/A=0/B=1#f/a=553182000/g=86400/h=86400/m=1/n=1/o=20 /q=12/z=15/3=0#d/a=+2.0000000/b=+1.5000000/c=+0.5000000/f=+1.0000000/g=+1.0000000/i=+0.0000000/j=+0.0000000/k=+0.0000000/m=+1.0000000/n=+50.000000/o=+400.00000/p=+0.0000000/q=+998.20001/r=+1.0000000/s=+0.0000000/t=+0.0000000/u=+0.0000000/v=+0.0000000/w=+0.0000000/0=+8.7475442/1=+47.4984242/2=+450.00000#k/a=ftp.gsmdata.ch/b=datamaner_103@gsmdata.ch/c= XXXXXX/d=ARC/e=21/f=21/g=0/h=ARC_Database#0/g=0 #E/e
```

1.1.2 Limitation

Because of the command structure of the ARC-1, *certain characters are forbidden to use* when parameterize the ARC-1 (for example with GSM Setup).

Please remind that the ARC-1 only support the ASCII character set, from ASCII value "space" (32, 0x20) to "~" (126, 0x7E)

1.1.2.1 Not supported characters by GSM Setup:

| ASCII | " | # | ' | (|) | , | / | : | ; | < | = | > | [| \ |] |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Wert | 34 | 35 | 39 | 40 | 41 | 44 | 47 | 58 | 59 | 60 | 61 | 62 | 91 | 92 | 93 |
| | 0x22 | 0x23 | 0x27 | 0x28 | 0x29 | 0x2C | 0x2F | 0x3A | 0x3B | 0x3C | 0x3D | 0x3E | 0x5B | 0x5C | 0x5D |

1.1.2.2 not supported characters for SMS:

| ASCII | " | # | ' | (|) | , | / | : | ; | < | = | > | [| \ |] |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Wert | 34 | 35 | 39 | 40 | 41 | 44 | 47 | 58 | 59 | 60 | 61 | 62 | 91 | 92 | 93 |
| | 0x22 | 0x23 | 0x27 | 0x28 | 0x29 | 0x2C | 0x2F | 0x3A | 0x3B | 0x3C | 0x3D | 0x3E | 0x5B | 0x5C | 0x5D |

| ASCII | ^ | { | } | ~ |
|-------|------|------|------|------|
| Wert | 94 | 123 | 125 | 126 |
| | 0x5E | 0x7B | 0x7D | 0x7E |

1.1.2.3 Character set for a configuration change over E-mail/FTP

<command> and <variable name> are only processed in the range **0...9, a...z, A...Z**. Anything else get discarded.

<variable values> are scanned and only ASCII characters in the range "space" to "z" (32 ... 122) get processed. Remaining characters get ignored!



1.2 Command table for E-Mail / FTP

All commandos with lowercase letters can be changed or adjusted via remote access. The commands with capital letters cannot be changed (except the command #O/g -> Acknowledge for the ARC-1) and are only for sent information.

1.2.1 General Content

1.2.1.1 #B Base64

| Variable name | Description | Example / Range | Firmware Version |
|---------------|--|--|------------------|
| /a | Base64: binary data in an ASCII string format (Record data transfer enabled) | /a=[Base64 encoded content] See on page | 17.26 |

1.2.1.2 #C Additional information about content

| Variable name | Description | Example / Range | Firmware Version |
|---------------|-----------------------------------|------------------------------------|------------------|
| /a | Start record page | /a=82 Range: 0 ... 8191 | 17.26 |
| /b | Number of record pages | /b=8 Range: 0 ... 30 | 17.26 |
| /m | Start of requested "ERROR" page | /m=2500 Range: 0 / 2000... 3999 | 17.26 |
| /n | Number of requested "ERROR" pages | /n=30 Range: 0 ... 300 | 17.26 |
| /o | Start of the "ERROR" memory | /o=2000 (fixed value) | 17.26 |
| /p | End of the "ERROR" memory | /p=3999 (fixed value) | 17.26 |

1.2.1.3 #E End sign

| Variable name | Description | Example | Firmwar Version |
|---------------|--------------------------------|---------|-----------------|
| /e | End sign of E-Mail or FTP file | #E/e | 17.26 |

1.2.1.4 #F Message type / file

| Variable name | Description | Example | Firmware Version |
|---------------|--|---------|------------------|
| /a | Measurement | #F/a=0 | 17.26 |
| /b | Configuration without acknowledge (Info only) | #F/b=0 | 17.26 |
| /c | Alarm | #F/c=0 | 17.26 |
| /d | Configuration with acknowledge (Response to configuration changes and to manually send) | #F/d=0 | 17.26 |
| /e | Record data (measurements) | #F/e=0 | 17.26 |
| /f | Requested record data via remote access | #F/f=0 | 17.26 |
| /g | "ERROR" Report | #F/g=0 | 17.26 |

1.2.1.5 #G Text

| Variable name | Description | Example | Firmware Version |
|---------------|----------------------------|-----------------------|------------------|
| /a | Text to measurement values | #G/a=MEASURE ARC SN10 | 17.26 |
| /b | Text to alarm values | #G/a=ALARM ARC SN10 | 17.26 |
| /c | Text to check values | #G/a=CHECK ARC SN10 | 17.26 |



1.2.1.6 #I Information

| Variable name | Description | Example | Firmware Version |
|---------------|-------------------------|---|------------------|
| /n | Serial number | /n=5 (max. 8 ASCII) | 17.26 |
| /s | Signal quality | /s=24 [0 ... 31] -> [-113dBm...-51dBm] 2 dBm per step | 17.26 |
| /b | Battery capacity in [%] | /b=96 Range: 0...99 / Default: 99 | 17.26 |
| /e | Device ID and CLASS | /e=9.20 (ARC-1) | 17.26 |
| /f | Software version | /f=18.12 [YY.KK] | 17.26 |
| /h | Rel. humidity in [%] | /h=41 | 17.26 |
| /v | Battery voltage in [V] | /v=3.902 | 17.26 |

1.2.1.7 #M Measurement

| Variable name | Description | Example | Firmware Version |
|---------------|--|---|------------------|
| /a | Current values (only selected channels / Configuration and Record files) | /a=-0.9611795+0.0002412+26.69 8974+0.9614199+28.260000+0.0 005353+0.0003824 | 17.26 |
| /b | Saved values (only selected channels and only if "Record data transfer" is disabled) | /b=-0.9611795+0.0002412+26.69 8974+0.9614199+28.260000+0.0 005353+0.0003824 | 17.26 |
| /c | Digital inputs "0" or "1" All | /c=+1+1 | 17.26 |
| /d | Current values (all available channels / Configuration file only) | /d=-0.9611795+0.0002412+OFL+ OFL+26.698974+OFL+0.9614199+ 28.260000+0.0005353+0.000382 4 | 17.26 |

1.2.1.8 #O Acknowledge (16 Bit)

| Variable name | Description | Example | Firmware Version |
|---------------|---|----------|------------------|
| /f | To ARC-1 (send acknowledge to the ARC-1) <u>Note: The number is used as confirmation for sent configuration change</u> | /f=12345 | 17.26 |
| /g | From ARC-1 (response the acknowledge number (12345) from the configuration change via remote access) If /g= 0 then this is a "Info" message or a manually send configuration | /g=0 | 17.26 |

1.2.1.9 #R "Error" Report

| Variable name | Description | Example | Firmware Version |
|---------------|----------------|--|------------------|
| /a | „ERROR“ Report | /a=\$631317600,116,1, +CME ERROR: 10 Means: /a=\$Time in seconds, AT command, failure number, Error text | 17.26 |



1.2.1.10 #T Time information

| Variable name | Description | Example | Firmware Version |
|---------------|---|--|------------------|
| /s | Main time in seconds after the year 1.1.2000 0:0:0 <i>Range: [0 ... 2³²]</i> | /s=581094554 -> 31.05.2018 15:09:14 | 17.26 |
| /p | Provider time If network operator does not support system clock update message, the initial date, time and time zone, displayed could be invalid ASCII format: yy.MM.dd,hh:mm:ss±zz yy: 2-digit year [2000-2069] MM: 2-digit month [01-12] dd: 2-digit day of month [00-31] hh: 2-digit hour [00-23] mm: 2-digit minute [00-59] ss: 2-digit seconds [00-59] zz: (optional) time zone offset from GMT, in quarter-hours [-47...+48]. If this value is not specified, the time zone offset will be 0. when function is not supported, ARC-1 returns date: /p=00.01.01,00:00:00+00 | /p=18.05.31,17:08:58+08 | 17.26 |
| /m | Measure time Time last measured values was stored (only when "Record data transfer" is disabled) | /m=581094554 -> 31.05.2018 15:09:14 | 17.26 |

1.2.1.11 #X CRC16

| Variable name | Description | Example | Firmware Version |
|---------------|---|----------------------|------------------|
| /a | CRC16 as decimal number (always 5-digits) (will be appended at the end of message in unencrypted state for each measurement file) | /a=05473 See page | 17.26 |



1.2.2 Configuration

1.2.2.1 #a GPRS Settings

| Variable name | Description | Example / Range | Length / Type | Firmware Version |
|---------------|------------------------------------|-------------------------------|---------------|------------------|
| /a | Access Point Name (APN / Provider) | /a=gprs.swisscom.ch | 50 char | 17.26 |
| /b | Cellular Username (Provider) | /b=gprs | 50 char | 17.26 |
| /c | Cellular Password(Provider) | /c=gprs | 50 char | 17.26 |
| /d | DNS Server (optional) | /d=xxx.xxx.xxx.xxx | 50 char | 17.26 |
| /e | E-Mail Alias (E-Mail forwarder) | /e=ARC-1 | 50 char | 17.26 |
| /f | E-Mail POP3 Login ID | /f=gsm_103@gsmdata.ch | 50 char | 17.26 |
| /g | E-Mail POP3 Password | /g=XXXXX | 50 char | 17.26 |
| /h | E-Mail SMTP Login ID (optional) | /h=datamanager_103@gsmdata.ch | 50 char | 17.26 |
| /i | E-Mail SMTP Password (optional) | /i=XXXXX | 50 char | 17.26 |
| /j | E-Mail POP3 Server Address | /j=pop.mail-ch.ch (with SSL) | 50 char | 17.26 |
| /k | E-Mail POP3 Port | /k=995 (with SSL) | 50 char | 17.26 |
| /l | E-Mail SMTP Server Address | /l=smtp.mail-ch.ch (with SSL) | 50 char | 17.26 |
| /m | E-Mail SMTP Port | /m=465 (with SSL) | 50 char | 17.26 |
| /n | E-Mail Return Address | /n=gsm_103@gsmdata.ch | 50 char | 17.26 |

1.2.2.2 #b Text, Number and Addresses

| Variable name | Description | Example / Range | Length / Type | Firmware Version |
|---------------|--|-------------------------------|---------------|------------------|
| /a | E-Mail Address Measure | /a=datamanager_103@gsmdata.ch | 50 char | 17.26 |
| /b | E-Mail Address Alarm | /a=datamanager_103@gsmdata.ch | 50 char | 17.26 |
| /c | E-Mail Address Info | /a=datamanager_103@gsmdata.ch | 50 char | 17.26 |
| /g | SMS Confirmation password | /g=Keller | 10 char | 17.26 |
| /j | SIM Pin | /j= | 10 char | 17.26 |
| /k | Data connection call number used to connect with a modem (Logger) | /k= | 30 char | 17.26 |
| /m | Measure SMS number | /m=+41791234567 | 30 char | 17.26 |
| /n | Alarm SMS number | /n=+41791234567 | 30 char | 17.26 |
| /o | Info SMS number | /o=+41791234567 | 30 char | 17.26 |
| /q | SMS Service Center number <u>Note: not changeable via remote access</u> | /q=+41794999000 | 30 char | 17.26 |
| /r | Network name (Position) | /r=Keller Entwicklung | 20 char | 17.26 |
| /s | SIM Card number (unique identifier for the data manager) | /s=+41774293910 | 30 char | 17.26 |
| /t | Location name (Position) | /r=ARC 3G neu | 20 char | 17.26 |
| /u | Measurement (customised text message for measurements) | /u=MEASURE message | 160 char | 17.26 |



| | | | | |
|----|---|------------------|----------|-------|
| /v | Alarm (customised text message for alarm) | /v=ALARM message | 160 char | 17.26 |
| /w | Answer (customised text message for configuration response) | /w=CHECK message | 160 char | 17.26 |
| /0 | Longitude text | /0=8.7475439 | 20 char | 17.26 |
| /1 | Latitude text | /1=47.4984244 | 20 char | 17.26 |
| /2 | Altitude text | /2=450.000 | 20 char | 17.26 |
| /3 | CellLocate Longitude <u>Note: not directly changeable via remote access (Execute #e/l)</u> | /3=8.746532 | 20 char | 17.26 |
| /4 | CellLocate Latitude <u>Note: not directly changeable via remote access (Execute #e/l)</u> | /4=47.500267 | 20 char | 17.26 |
| /5 | CellLocate Altitude <u>Note: not directly changeable via remote access (Execute #e/l)</u> | /5=0 | 20 char | 17.26 |

1.2.2.3 #k FTP Settings

| Variable name | Description | Example | Length / Type | Firmwar Version |
|---------------|--------------------------------------|-------------------------------|---------------|-----------------|
| /a | FTP Server Name (FTP Host URL or IP) | /a=ftp.gsmdata.ch | 50 char | 17.26 |
| /b | FTP Login ID | /b=datamanager_103@gsmdata.ch | 50 char | 17.26 |
| /c | FTP Password | /c=XXXXX | 50 char | 17.26 |
| /d | FTP Account | /d=ARC-1 | 50 char | 17.26 |
| /e | FTP source control port | /e=21 (fix / not used) | 5 char | 17.26 |
| /f | FTP destination control port | /f=21 | 5 char | 17.26 |
| /g | FTP source data port | /g=0 (fix / not used) | 5 char | 17.26 |
| /h | FTP File Path | /h=ARC_Database | 50 char | 17.26 |

1.2.2.4 #c measurement settings

| Variable name | Description | Example | Length / Type | Firmwar Version |
|---------------|--|--|---------------------------|-------------------|
| /a | Timer "Measure" (next measuring date) Range: <i>Main Time</i> + 0 ... 5184000 sec (60 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | #c/a=581097900 -> 31.05.2018 16:05:00 | unsigned 32 / ASCII | 17.26 (F100/1) |
| /b | Timer "Alarm" Range: <i>Main Time</i> + 0 ... 5184000 sec (60 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /b=581094300 -> 31.05.2018 15:05:00 | unsigned 32 / ASCII | 17.26 (F100/2) |
| /c | Timer "Info" Range: <i>Main Time</i> + 0 ... 5184000 sec (60 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /c=581162400 -> 01.06.2018 10:00:00 | unsigned 32 / ASCII | 17.26 (F100/3) |
| /d | Timer "Check" Range: <i>Main Time</i> + 0 ... 5184000 sec (60 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /d=581155200 -> 01.06.2018 08:00:00 | unsigned 32 / ASCII | 17.26 (F100/4) |
| /e | Timer "Data Connection" Range: <i>Main Time</i> + 0 ... 5184000 sec (60 days) | /e=553182000 -> 12.07.2017 13:40:00 | unsigned 32 / | 17.26 (F100/5) |



| | | | | |
|----|--|--|---------------------------|----------------------|
| | <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | | ASCII | |
| /g | Interval "Measure" Range: 1 ... 2592000 sec (30 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /g=300 -> 5 min | unsigned 32 / ASCII | 17.26 (F100/6) |
| /h | Interval "Alarm" Range: 1 ... 2592000 sec (30 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /h=300 -> 5 min | unsigned 32 / ASCII | 17.26 (F100/7) |
| /i | Interval "Info" Range: 1 ... 2592000 sec (30 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /i=86400 -> 1 day | unsigned 32 / ASCII | 17.26 (F100/8) |
| /j | Interval "Check" Range: 1 ... 2592000 sec (30 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /j=86400 -> 1 day | unsigned 32 / ASCII | 17.26 (F100/9) |
| /k | Interval "Data Connection" Range: 1 ... 2592000 sec (30 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /k=86400 -> 1 day | unsigned 32 / ASCII | 17.26 (F100/10) |
| /m | Measure / Save channels 0 ... 7 | /m=211 -> 1101'0011 (Channel: 0,1,4,6,7) | 1 Byte / ASCII | 17.26 (F100/11_0) |
| /n | Reserved / no function | /n=0 | 1 Byte / ASCII | 17.26 (F100/11_1) |
| /o | Collect measurements (SMS only) Send an SMS after x measurementst | /o=1 | 1 Byte / ASCII | 17.26 (F100/11_2) |
| /p | Measure / Save channels 8 ... 15 | /p=3 -> 0000'0011 (Channel: 8, 9) | 1 Byte / ASCII | 17.26 (F100/11_3) |
| /q | Collect measurements (E-Mail only) Send an E-Mail after x measurementst | /q=1 | 1 Byte / ASCII | 17.26 (F100/11_4) |
| /r | Alarm Channel | /r=1 | 1 Byte / ASCII | 17.26 (F100/12_0) |
| /s | Alarm Type 1-> On / Off 2-> Delta 3-> Digital Input | /s=1 | 1 Byte / ASCII | 17.26 (F100/12_1) |
| /t | Alarm Retry (Send the Alarm x times if the condition is still true) | /t=2 | 1 Byte / ASCII | 17.26 (F100/12_2) |
| /v | Resolution Pressure (SMS only) | /v=6 -> (+)0.9559 | 1 Byte / ASCII | 17.26 (F100/14) |
| /w | Resolution Temperature (SMS only) | /w=4 -> (+)24.4 | 1 Byte / ASCII | 17.26 (F100/15) |



| | | | | |
|----|--|---|-------------------|----------------------|
| | | | |) |
| /x | Lock Timer (Check only) Only "Check" Bit can be changed | /x=8 | 1 Byte / ASCII | 17.26 (F100/16_0) |
| /y | Lock Timers "Check" Bit cannot be changed (only with variable name "x") Bit. Pos. 0-> Measure Bit. Pos. 1-> Alarm Bit. Pos. 2-> Info Bit. Pos. 3-> Check Bit. Pos. 4-> Dial | /y=13 -> Measure, Info, Check is active | 1 Byte / ASCII | 17.26 (F100/16_0) |
| /z | Send Type SMS / E-Mail To ensure that a "Check" Function is always active, when "Check" E-Mail is switched off Check FTP is automatically activated Bit. Pos. 0-> Measure SMS Bit. Pos. 1-> Alarm SMS Bit. Pos. 2-> Info SMS Bit. Pos. 3-> Check SMS Bit. Pos. 4-> Measure E-Mail Bit. Pos. 5-> Alarm E-Mail Bit. Pos. 6-> Info E-Mail Bit. Pos. 7-> Check E-Mail | /z=40 -> Check SMS, Alarm E-Mail is active | 1 Byte / ASCII | 17.26 (F100/16_1) |
| /0 | Modem Protocol (V.32, V.34, V.110) 0-> 9600bps (V.32) 1-> 9600bps (V.34) 2-> 9600bps (V.110) <u>Note: Not working with 3G/4G</u> | /0=0 -> 9600bps (V.32) | 1 Byte / ASCII | 17.26 (F100/16_2) |
| /1 | E-Mail SSL Settings Bit. Pos. 0-> SSL (SMTP) Bit. Pos. 1-> SSL (POP3) | /1=3 -> SSL active for POP and SMTP | 1 Byte / ASCII | 17.26 (F100/16_3) |
| /2 | Alternative Login for SMTP 0-> same logging 1-> different logging for SMTP | /2=0 | 1 Byte / ASCII | 17.26 (F100/16_4) |
| /3 | Water Level Configuration Poleni / Venturi ->Form type 0-> none 1-> A (0.85-0.88) 2-> B (0.87-0.95) 3-> C (1.13-1.27) 4-> D (1.11) 5-> E (1.30) 6-> F (1.37) 7-> Venturi (1.75-2.02) 8-> Open tube (0.529) | /3=0 -> none | 1 Byte / ASCII | 17.26 (F100/28_3) |
| /4 | Select Supply (Sensor) 0-> Deactivated 1-> +12 V 2-> + 5 V 3-> +3.9 V 4-> all On | /4=3 -> 3.9 V activated | 1 Byte / ASCII | 17.26 (F100/18_2) |
| /5 | Supported Sensor Types (defines how many Sensor types are supported from the firmware) <u>Note: not changeable</u> | /5=12 | 1 Byte / ASCII | 17.26 (F100/18_3) |



| | | | | |
|----|---|---|-------------------|-----------------------|
| /6 | Connection Type (Sensor) See Device type overview 6 | /6=5 | 1 Byte / ASCII | 17.26 (F100/18_4) |
| /7 | Water Level Configuration Sensor Type <u>Note: get ignored from data manager version 2.3 or higher</u> 0-> vg 1-> sg | /7=0 | 1 Byte / ASCII | 17.26 (F100/28_2) |
| /8 | Water Level Configuration Calculate water level from 0-> P ₁ -P ₂ 1-> P ₁ -P _{BARO} 2-> P ₁ relative 3-> not defined | /8=2 -> P ₁ relative | 1 Byte / ASCII | 17.26 (F100/28_0) |
| /9 | Water Level Configuration Conversion to 0-> Height of water above level sensor (e) 1-> Distance to water surface (f) 2-> Height of water above sea level (g) 3-> Overflow (Poleni) 4-> Overflow (Thomson) | /9=0 -> Height of water above level sensor (e) | 1 Byte / ASCII | 17.26 (F100/28_1) |
| /A | FTP TLS Settings 0-> none 1-> TLS security | /A=0 -> none | 1 Byte / ASCII | 17.26 (F100/100_0) |
| /B | FTP Mode (active / passive) 0-> passive mode 1-> active mode <u>Note: not changeable via remote access</u> | /B=1 -> active mode | 1 Byte / ASCII | 18.09 (F100/100_1) |

1.2.2.5 #f measurement settings 2

| Variable name | Description | Example | Length / Type | Firmware Version |
|---------------|--|--|---------------------------|----------------------|
| /a | Timer "Event Measure" (next event measuring date) Range: <i>Main Time</i> + 0 ... 5184000 sec (60 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /a=553182000 -> 12.07.2017 13:40:00 | unsigned 32 / ASCII | 17.26 (F100/31) |
| /g | Interval "Event Check" Range: 1 ... 2592000 sec (30 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /g=86400 -> 1 day | unsigned 32 / ASCII | 17.26 (F100/32) |
| /h | Interval "Event Measure" Range: 1 ... 2592000 sec (30 days) <u>Note: Values outside the range will be automatically fitted to the next nearest value</u> | /h=86400 -> 1 day | unsigned 32 / ASCII | 17.26 (F100/33) |
| /m | Event Channel (Channel 0 ... 15) | /m=1 | 1 Byte / ASCII | 17.26 (F100/30_0) |
| /n | Event Type | /n=1 | 1 Byte | 17.26 |



| | | | | |
|----|---|---|-------------------|----------------------|
| | 0-> deactivated 1-> activated (data transmission in record format) 2-> On / Off 3-> Delta / Save 4-> Delta / Send | -> data transmission in record format | / ASCII | (F100/30_1) |
| /o | Max Amount of E-Mail/FTP files with Record data until they will be send | /o=20 Range: 1 ... 30 | 1 Byte / ASCII | 17.26 (F100/30_2) |
| /q | Collect measurements (FTP only) Send FTP after x measurement | /q=12 | 1 Byte / ASCII | 17.26 (F100/27_4) |
| /z | Send Type FTP To ensure that a "Check" Function is always active, when "Check" FTP switched off "Check" E-Mail is automatically activated Bit. Pos. 0-> Measure FTP Bit. Pos. 1-> Alarm FTP Bit. Pos. 2-> Info FTP Bit. Pos. 3-> Check FTP | /z=15 -> Measure FTP, Alarm FTP, Info FTP, Check FTP is active | 1 Byte / ASCII | 17.26 (F100/27_1) |
| /3 | Pre ON Time (Sensor) Gives power to the external sensor defined seconds before read out | /3=0 Range: 0 ... 254 | 1 Byte / ASCII | 17.26 (F100/18_1) |

1.2.2.6 #d floating point values

| Variable name | Description | Example | Firmware Version |
|---------------|--|----------------|-------------------|
| /a | Alarm On threshold | /a=+2.0000000 | 17.26 (F30/0) |
| /b | Alarm Off threshold | /b=+1.5000000 | 17.26 (F30/1) |
| /c | Alarm Delta threshold | /c=+0.5000000 | 17.26 (F30/2) |
| /f | Gain Temperature (for SMS only) Value has to be greater than 0 otherwise changed to 1 | /f=+1.0000000 | 17.26 (F30/3) |
| /g | Gain Pressure (for SMS only) Value has to be greater than 0 otherwise changed to 1 | /g=+1.0000000 | 17.26 (F30/4) |
| /i | Event On threshold | /i=+0.0000000 | 17.26 (F30/6) |
| /j | Event Off threshold | /j=+0.0000000 | 17.26 (F30/7) |
| /k | Event Delta threshold | /k=+0.0000000 | 17.26 (F30/8) |
| /m | Water Level Configuration Enable | /m=+1.0000000 | 17.26 (F30/10) |
| /n | Water Level Configuration Length (B) | /n=+50.0000000 | 17.26 (F30/11) |



| | | | |
|----|--|----------------|-------------------|
| /o | Water Level Configuration Height (A) | /o=+400.00000 | 17.26 (F30/12) |
| /p | Water Level Configuration Offset (f) | /p=+0.0000000 | 17.26 (F30/13) |
| /q | Water Level Configuration Density | /q=+998.20000 | 17.26 (F30/14) |
| /r | Water Level Configuration Width (b) | /r=+1.0000000 | 17.26 (F30/15) |
| /s | Water Level Configuration Angle (F) | /s=+0.00000000 | 17.26 (F30/16) |
| /t | Water Level Configuration Form factor (m) | /t=+0.00000000 | 17.26 (F30/17) |
| /u | Water Level Configuration Minimum calculation Height (h) | /u=+0.00000000 | 17.26 (F30/18) |
| /v | Water Level Configuration Reserve | /v=+0.00000000 | 17.26 (F30/19) |
| /w | Water Level Configuration Reserve | /w=+0.00000000 | 17.26 (F30/20) |
| /0 | GPS coordinate as float (Longitude) | /0=+8.7475442 | 17.26 (F30/24) |
| /1 | GPS coordinate as float (Latitude) | /1=+47.498424 | 17.26 (F30/25) |
| /2 | GPS coordinate as float (Altitude) | /2=+450.00000 | 17.26 (F30/26) |



1.2.3 Execute specific functions of the ARC-1 via remote access

1.2.3.1 #e correct time / set commands

| Variable name | Description | Example | Firmware Version |
|---------------|---|---|------------------|
| /a | Request record data Start time | /a=580824000 -> 28.05.2018,12:00:00+08 | 17.26 |
| /b | Request record data Stop time | /b=581083200 -> 31.05.2018,12:00:00+08 | 17.26 |
| /l | Telit Cell Locate function This is a triangulation of the antenna around the ARC-1 which returns the GPS coordinates <u>Limitation: max. 1 query per hour</u> | /l=1 -> the ARC-1 will execute a Cell Location | 17.26 |
| /m | "Error" Report start page m=0 -> gives the newest error back (30 pages) | /m=0 Range: 2000 ... 3999 | 17.26 |
| /n | "Error" Report number of pages Return the number of pages | /n=1 Range: 1 ... 300 | 17.26 |
| /t | Correct the "Main" Time of the corresponding correction factor max. ±172800 sec. ±2 days | /t=+600 -> add 10 min to the "Main" time | 17.26 |



2 RECORD EEPROM (MEMORY-MAP)

The total memory is divided into “pages”, therefore each “page” consist of 64 bytes. The number of “pages” may vary depending on the device type. The ARC-1 has currently a memory of 4Mbit with 8192 “pages”, therefore the last 8 “pages” are reserved for the free use of the customer.

The first 8 byte are used as header. All following bytes are actual data. A data set consists of four byte. These include the measured variable / channel and the corresponding measured value.

RECORD-Memory (4 Mbit)

| Page | Bemerkung |
|------|-------------------|
| 0 | start data memory |
| 1 | |
| 2 | |
| ... | |
| ... | |
| ... | |
| x | end data memory |
| ... | |
| 8183 | start user „page“ |
| ... | |
| ... | |
| 8091 | end user „page“ |

1 Page (64 Byte)

| Byte | Bemerkung |
|----------------|---|
| Header | |
| 0 | Status Byte / Record Startpage (higher start pointer) |
| 1 | Record Startpage (lower start pointer) |
| 2 | Time (Byte 1) |
| 3 | Time (Byte 2) |
| 4 | Time (Byte 3) |
| 5 | Time (Byte 4) |
| 6 | Reserviert |
| 7 | Reserviert |
| Data 0 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| Data 1 | |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| ... | |
| ... | |
| Data 14 | |
| 60 | |
| 61 | |
| 62 | |
| 63 | |

Comment:

A new record always starts on a new page. An empty data packet (0xFF) shows the end of a record.

2.1 Header

The Header of each „page“ (Record) always consist of 8 Bytes which is composed as follows:

Byte 0: **Status Byte / Record Startpage**

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------------|-----------------|------------------|---|----------------------|---|---|---|---|
| Byte 0 | Start detection | Overflow counter | | Start pointer (High) | | | | |

Start detection: If this bit is set '1' this means that this page is the beginning of a record

Overflow counter: is incremented when the last page has been reached and it begins again at the first page

Start pointer: displays the page, where the record was started. Superior 5 bits of the Record start page (Start pointer).



Byte 1: Low order Byte of the **record start page** (lower Byte). Together with Byte 0 (Bit 0 ... Bit 4), this forms the complete **record start page** (8Bit + 5Bit = 13Bit -> $2^{13} = 8192$. This means that 8192 „pages“ can be addressed.

Byte 2...5: **Absolute time** in seconds[s] ($0 \dots 2^{32} - 1 = 49710 \text{ T} = 136 \text{ J}$) from the 01.01.2000, 00:00:00

Byte 6 + 7: **Reserved** for future use

2.2 Data packet

A data packet consists of 4 bytes. There are two types of data packets:

Measurement data

| Byte | Description |
|------|---|
| 0 | channel (0 ... 14) Time interval to the previous data packet (0 ... 15) ,0000' ... ,1110' ,0000' ... ,1111' |
| 1 | Measuring value Byte 3 |
| 2 | Measuring value Byte 2 |
| 3 | Measuring value Byte 1 |

Time stamp (Delay)

| Byte | Description |
|------|--|
| 0 | Signe for time stamp (0xF0) |
| 1 | Time delay to the previous data packet (3. Byte) |
| 2 | Time delay to the previous data packet (2. Byte) |
| 3 | Time delay to the previous data packet (1. Byte) |

A data packet with time delay will be generated, when time delay to previous data packet is higher than 15 seconds

The measuring value is a 4 byte float, where the last byte is omitted

Time delay ($2^{24}-1$) = 0 ... 16777215 s = 0 ... 194 T

The measurement data contains in addition to the channel (Byte 0) also the elapsed time (0 ... 15 seconds) to the previous measurements.

If the elapsed time between the measurements is greater than 15 seconds, a timestamp will be generated.



3 OVERVIEW MESSAGE TYPE

The ARC-1 can send different messages:

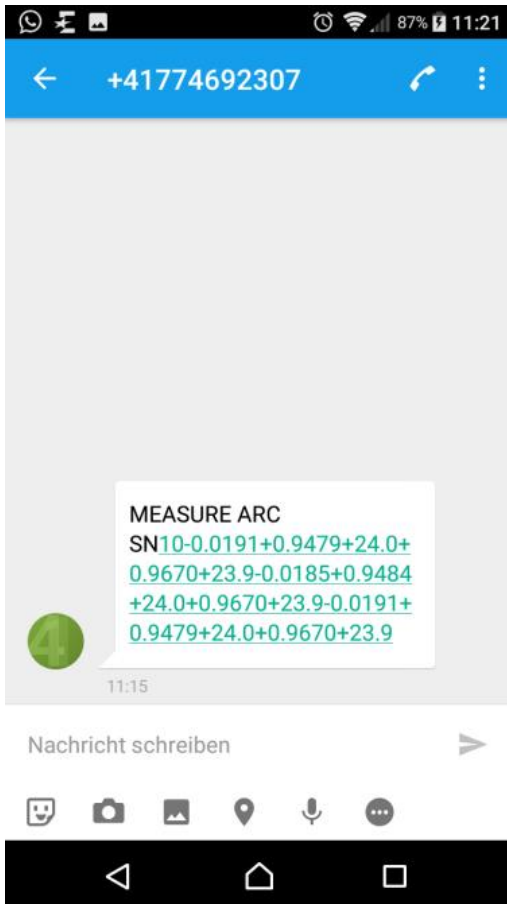
- **“Measure” message**
The ARC-1 measures in a defined interval the selected channels and transfers them together in one message.
- **“Info” message**
All useful information about the ARC-1 is transferred in a defined interval.
- **“Alarm” message**
An alarm message will be sent immediately if the alarm condition is true.
- **“Check” message (answer to a command)**
The ARC-1 will response to a command via remote access if a message is sent to it.



4 SMS

The messages from and to the ARC-1 are in TEXT – Mode (PDU-Mode is not supported). A message contains maximum 160 letters (limitation of the SMS function).

4.1 Description of the data format



Identifier “+41774692307”

The sender is identified by its telephone number. The phone number will be displayed on the top of the SMS.

Time information “11:15”

The time information, when the short message is received is included in each short message.

Text “MEASURE ARC SN10”

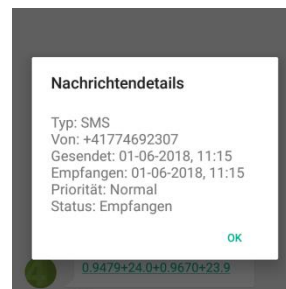
At the beginning of the message you can set an individual text to identify the device.

Data

The measurements follow direct after the “text” and each value is separated by a + or – sign.

All values are in that order how they are listed in the “Measuring channels / Save channels” setting.

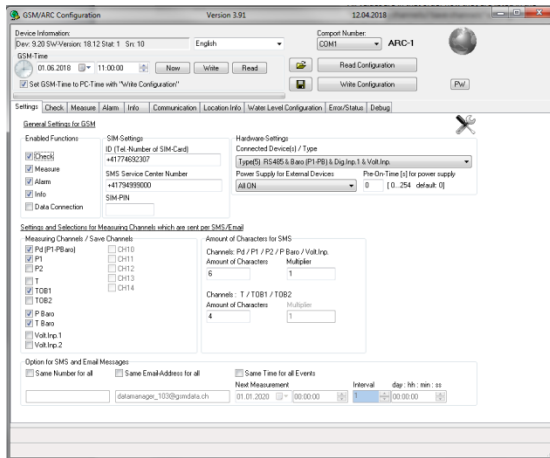
Note: Additional information about the sender and the time stamp can be seen in the SMS details on the phone





4.2 General Settings

These are the general settings for all following SMS Message types.



Measuring / Save channels

Settings: $P_d, P_1, TOB1, P_{Baro}, T_{Baro}$

(The selected channels will be collected and transferred by SMS)

Amount of character for SMS:

$P_d / P_1 / P_2 / P_{BARO} / Volt. Inp.:$

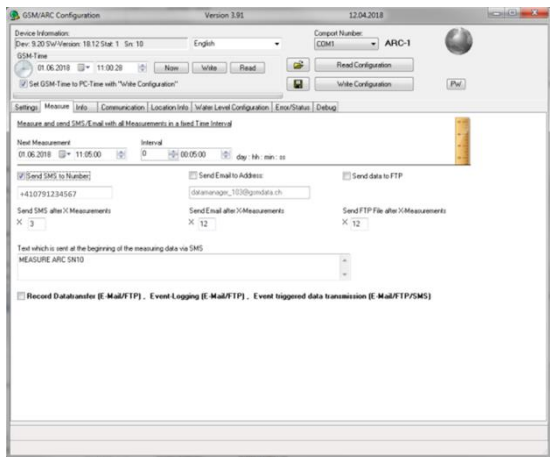
Settings: 6

$T / TOB1 / TOB2:$

Settings: 4

(These values will be transferred with this amount of characters)

4.2.1 "Measure"



Measure interval

Settings: 5 min

(All selected channels are measured in this interval)

Amount of measurements (sent in 1 SMS):

Settings: 3

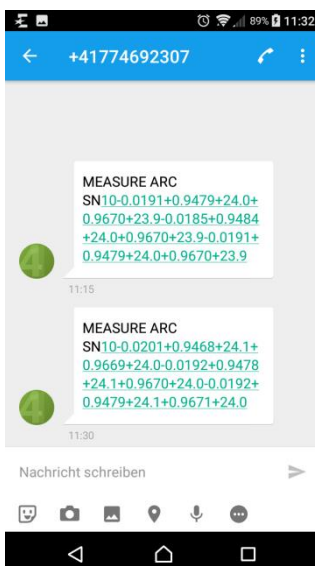
(The SMS send message with all collected values is sent after X measurements)

Text at the beginning of the message:

Settings: MEASURE ARC SN10

(Individual text at the beginning of the message could be used to identify the device)

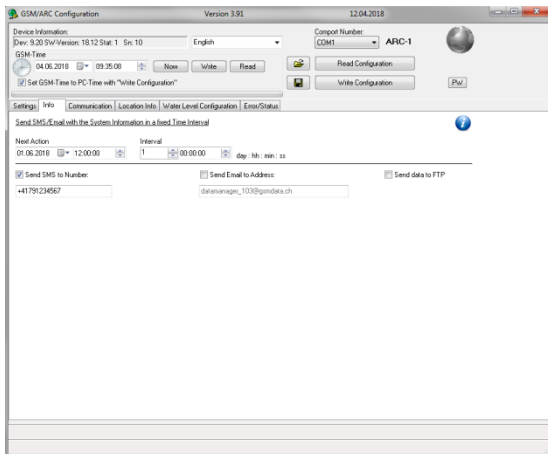
Since the start time of the measurement was set to "11:05:00, 01.06.2018" with an interval of "5 min" and after "3" collected measurement sets the message looks like follow:



| Time | P_D | P_1 | T_{TOB1} | P_{BARO} | T_{BARO} |
|------------------|---------|---------|------------|------------|------------|
| 1. SMS | | | | | |
| 01.06.2018 11:05 | -0.0191 | +0.9479 | +24.0 | +0.9670 | +23.9 |
| 01.06.2018 11:10 | -0.0185 | +0.9484 | +24.0 | +0.9670 | +23.9 |
| 01.06.2018 11:15 | -0.0191 | +0.9479 | +24.0 | +0.9670 | +23.9 |
| 2. SMS | | | | | |
| 01.06.2018 11:20 | -0.0201 | +0.9468 | +24.1 | +0.9669 | +24.0 |
| 01.06.2018 11:25 | -0.0192 | +0.9478 | +24.1 | +0.9670 | +24.0 |
| 01.06.2018 11:30 | -0.0192 | +0.9479 | +24.1 | +0.9671 | +24.0 |



4.2.2 "Info"



Info interval

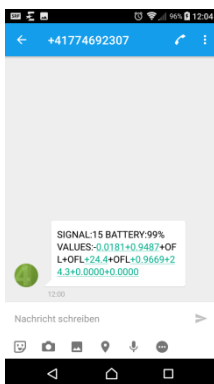
Settings: Every day from the 01.06.2018

Send to:

Settings: SMS only

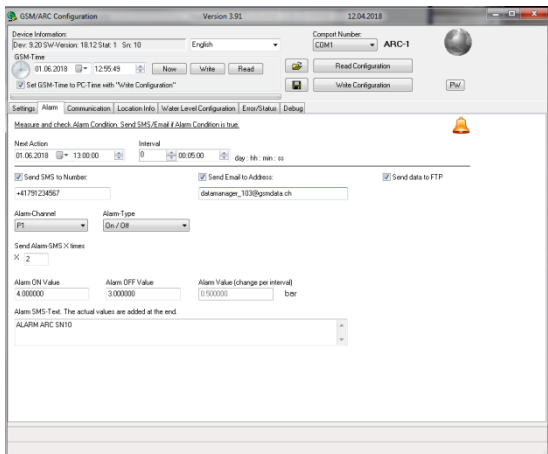
(Info message which is send to the defined number)

Since the start time of the info message was set to "12:00:00, 01.06.2018" with an interval of 1 day the message looks like follow:



| Keyword | Value / Meaning |
|-----------------|--|
| SIGNAL: | Shows the signal quality of the ARC-1. The value from 0 through 31 covers the range of -113 dbm (or less) to -51dbm (or greater) |
| BATTERY: | Indicates the calculated remaining battery capacity in percentage. Range 0...99 |
| VALUES: | All available actual values (measured at "Timestamp") are listed. Resolution is defined in the general settings. |

4.2.3 "Alarm"



Alarm interval

Settings: 5 min

(The alarm condition will be checked every 5 min and if the condition gets true an alarm message will be send immediately)

Alarm channel / Alarm type:

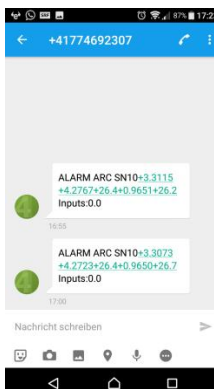
Settings: P1, On/Off

(Defines the channel and the type of the alarm)

Send Alarm X times:

Settings: 2

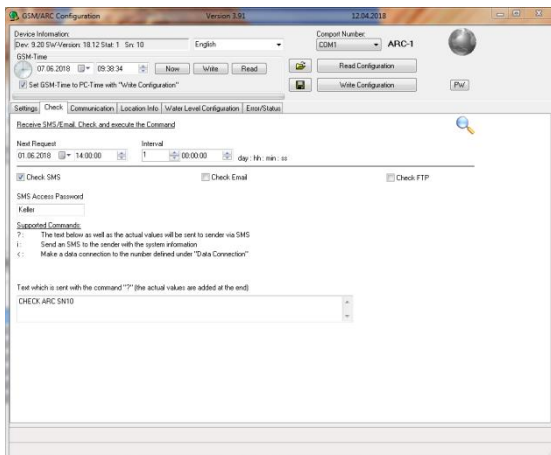
(The alarm messages are limited to two even the condition is still true. If the condition gets false again it will be reset)



| Keyword | Value / Meaning |
|----------------|--|
| Inputs: | Status of the digital inputs (0 = open 1 = closed) |



4.2.4 "Check"



Check interval:

Settings: Every day from the 01.06.2018

Check type:

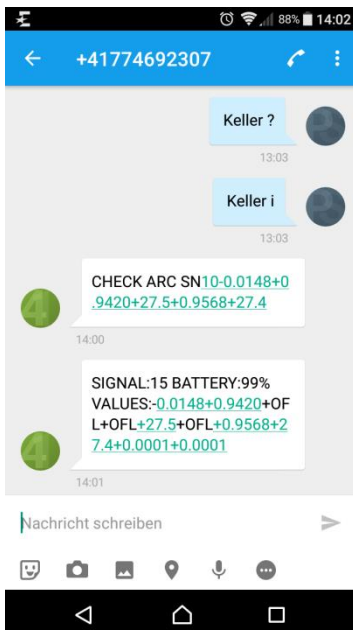
Settings: SMS only

Password

Settings: Keller

(The password is case sensitive)

To request the current measurement data "?" or the system information "i" an SMS must be send with the password and the command to the telephone number of the ARC-1.



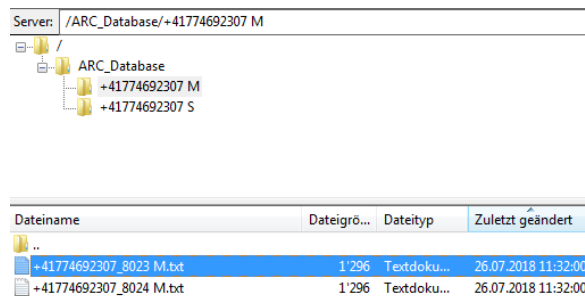


5 FTP / E-MAIL

The advantage of the FTP and the E-Mail functionality is the possibility of much larger message files as with SMS. A Configuration file includes all information/settings of the ARC-1. With the "Check" functionality the user has the possibility to change all settings which are described in the "Command table for E-Mail / FTP".

5.1 Description of the data format / storage

5.1.1 FTP (recommended)



Storage "/ARC_Database/+41774692307 M":

The FTP File will be saved on the FTP Server which has to enter in the register "Communication". The file will be stored on the FTP Server in the **root/FTP directory/ID(telephone number) " M"(Space M)**

Note: If the folder does not exist the ARC-1 tries to put the file in next upper directory until the root directory is reached.

Note. All files from the ARC-1 will be put in the "M" folder and all files for the ARC-1 (remote configuration) has to be put in the "S" folder respectively are automatically stored there by the data manager.

Note: The ARC-1 is not able to create folders on the FTP Server. Either you have to create the directories manually or the data manager generates them.

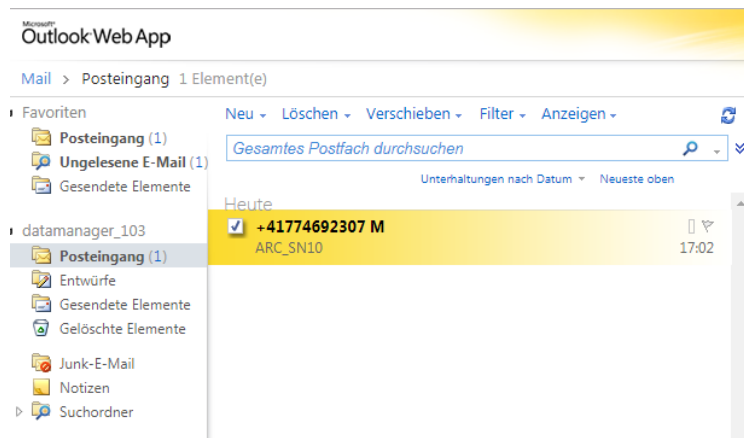
Identifier/ File name "+41774692307_8023 M.txt":

The filename consist of the ID followed by an underline (_) a continuous index (0...65535) and the origin (" M" (from the ARC-1)). The data will be stored as a text file.

Time information "26.07.2018 11:32:00":

The date and time on the FTP server indicates the creation time of the file. In the file itself there are additional time information of the measurement and the sending time.

5.1.2 E-Mail



Storage "Inbox":

The E-Mail will be saved in the inbox of the E-Mail Server which has to enter in the register "Communication".

Identifier "+41774692307 M":

The subject contains the ID followed by the origin " M"

Note. All files from the ARC-1 will have the pattern " M" and all files for the ARC-1 (remote configuration) must have the pattern " S" as origin.

E-Mail Alias (E-Mail forwarder) "ARC_SN10":

The E-Mail can be given a freely defined name, so that the E-Mail can be easily assigned.

Time information "26.07.2018 17:02:00":

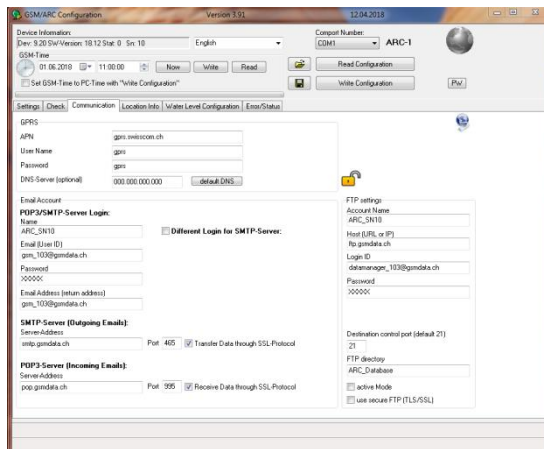
The date and time on the FTP server indicates the creation time of the file. In the file itself there are additional time information of the measurement and the sending time.



5.2 General Settings (used for these examples)

These are the general settings for all following used FTP/E-Mail Message types.

5.2.1 Communication



GPRS

This are the needed configurations to set up a connection to your carrier`s cellular network of your Sim card provider

E-Mail account

It is not recommended to use a "GMX"/ "GMAIL" account due to the strong security regulation of this Email provider.

FTP account

It is the best way to use an FTP server instead an E-mail server, due to the easier implementation and functionality

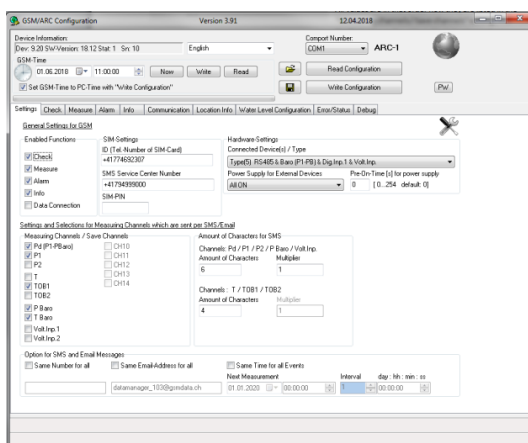
Security

Be sure that the Port number is corresponding to the needed FTP/ E-Mail provider settings.

| Security | ARC-1 |
|-----------|----------|
| None | yes |
| SSL / TLS | TLS v1.1 |
| STARTTLS | no |

Note: We recommend using at least two E-Mail accounts in conjunction with the Datamanager. An E-Mail account (outbox / example: datamanager_103@gsmdata.ch) to which the ARC-1 send the measurements and configurations and another E-Mail account (Inbox / example: gsm_103@gsmdata.ch) for configurations sent from the Datamanager to the ARC-1. Thus, the ARC-1 downloads only configurations. This protects the battery and keeps the cost of data transmission low.

5.2.2 Channels



ID

This number has to be unique and should be the phone number of the SIM card.

Connected Device / Type

Settings: Type 5

Measuring / Save channels

Settings: Pd, P1, TOB1, PBaro, TBaro

(The selected channels will be collected and transferred by FTP/E-Mail)

Amount of character for SMS:

Not used for FTP and E-Mail

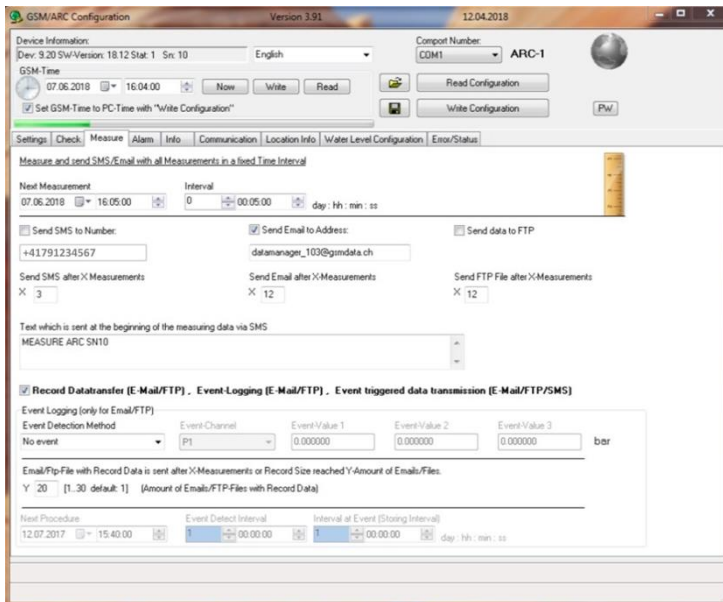
The Standard Resolution for FTP / E-Mail is: 9 Example: 0.9622050 bar
26.100002 °C

(All values will be transferred with this amount of characters)



5.3 Measure “#F/a” / “#F/e”

5.3.1 With “Record function” in Base64 “#F/e” (recommended)



Measure interval

Settings: 5 min

(All selected channels are measured in this interval)

Amount of measurements:

Settings: 12

(The FTP/E-Mail message with all collected values is sent after X measurements)

Text at the beginning of the message:

Settings: MEASURE ARC SN10

(Individual text at the beginning of the message could be used to identify the device)

Record Data transfer:

Settings: Activated (measure values will be send in Base64 as Record structure)

Note: When “record function” is activated on ARC-1, the stored (EEPROM “Record”) measurement data get compromised to base64 code and transferred. The ARC-1 device type information (#c/6) is transmitted with the [configuration file](#).



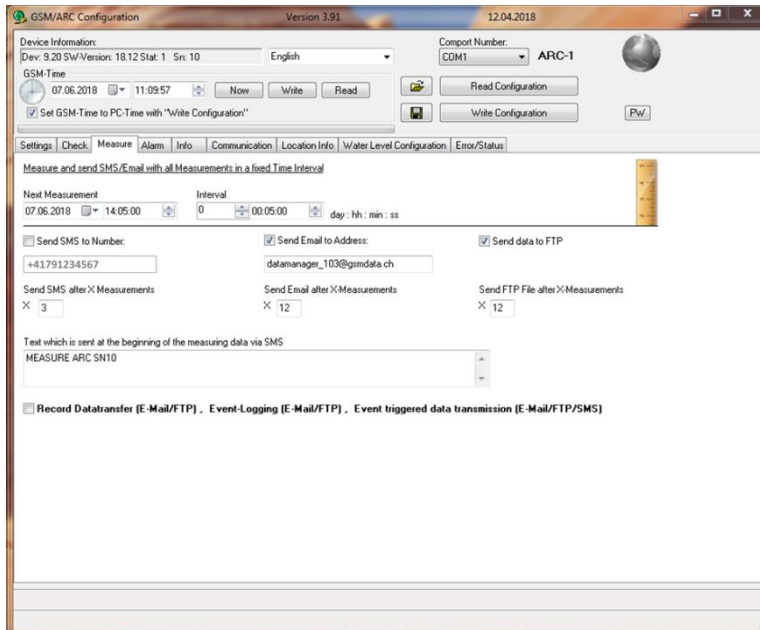
5.3.1.1 Example of the structure

#F/e=0#C/a=189/b=6#T/s=581756460/p=18.06.08,09:00:45+08#M/a=0.0184340+0.9424388+24.463745+0.9608600+24.270000/c=+1#I/n=10/s=22/b=99/e=9.20/f=18.12/h=52/v=+3.862#B/a=gL0irNkOAAAvtktED9xyEBBwfJgP3YOcEG+ZvAAASwAvIvPEd9x2kBBwXZgP3YICeG+UFAAASwAvIvIED9xrQC9lqzbZgAAQEHAvWA/dglwQb1c8AABLAC8j7gQP3GNQEHAlGA/dgpwQb498AABLAC8kPYQP3GBQEHA0mA/dgkAvSKs3b4AAHBvvrwAAEsALyTzBA/cWNAQcCUYD92A3BBvqPwAAEsALyDNRA/cRpAQcDSYD92AXBBv1z/////AL0irOfCAAaAvZpED9xTEBBwU1gP3X/cEHAKPAAASwAvKBNEd9w+UBBwfJgP3YAcEHBHvAAASwAvJdpED9xTAC9lqzjmgAAQEHCv2A/dgVwQcKP8AABLAC8mhcQP3EqQEHDDeGA/dgBwQcJm8AABLAC8lwMQP3FDQEHDtWA/dfoAvSKs5fIAAHHBwj/////##E/#X/a=55998

In addition to the encoded measurement data in Base64 (see 7 Decoding Base64/ page 33), a measurement message contains also the start page and the number of pages from the Record that have been transferred. Also the main time and the sending time (Provider) as well as the last measured values in plain text will be displayed. To each message, the device information (like serial number, signal quality, battery state, etc.) are appended.



5.3.2 In plain text “#F/a” (not recommended)



Measure interval

Settings: 5 min

(All selected channels are measured in this interval)

Amount of measurements:

Settings: 12

(The FTP/E-Mail message with all collected values is sent after X measurements)

Text at the beginning of the message:

Settings: MEASURE ARC SN10

(Individual text at the beginning of the message could be used to identify the device)

Record Data transfer:

Settings: Not activated (measure values will be send in plain text)

Note: When working with plain text transmission, recognize first which device type is active (#c/6) and check afterwards the activated channels (#c/m and #c/p) to know the measurement values order. This information only gets transmitted with configuration files, but not with normal measurement files.



5.3.2.1 Example of the structure

```
#F/a=0#T/s=581691726/p=18.06.07,15:00:45+08/m=581691602#M/b=-0.0198490+0.9427482+25.662841+0.9627599+25.459999-0.0213406+0.9413806+25.692749+0.9627200+25.489999-0.0202836+0.9423158+25.702758+0.9626600+25.579999-0.0209471+0.9418253+25.732666+0.9626700+25.600000-0.0207672+0.9418432+25.782470+0.9625800+25.670000-0.0206871+0.9419757+25.862060+0.9626100+25.790000-0.0220990+0.9403815+25.941650+0.9624500+25.889999-0.0207824+0.9416804+25.981445+0.9624500+25.969999-0.0211960+0.9409048+26.041137+0.9622799+25.920000-0.0212197+0.9409620+26.071044+0.9621999+25.920000-0.0207112+0.9413917+26.090820+0.9620500+25.909999-0.0221069+0.9399211+26.120605+0.9620200+25.979999/c=+1+1#I/n=10/s=16/b=99/e=9.20/f=18.12/h=49/v=+3.869#G/a=MEASURE ARC SN10#E/#X/a=60930
```

Unlike the transmission in the “Record format”, the message contains only the times (main time, provider time and additional the (last) measurement time), the data in “plain text” format, the device information and a user defined text.

/m=581691602 -> 07.06.2018 13:00:02 (last measurement)

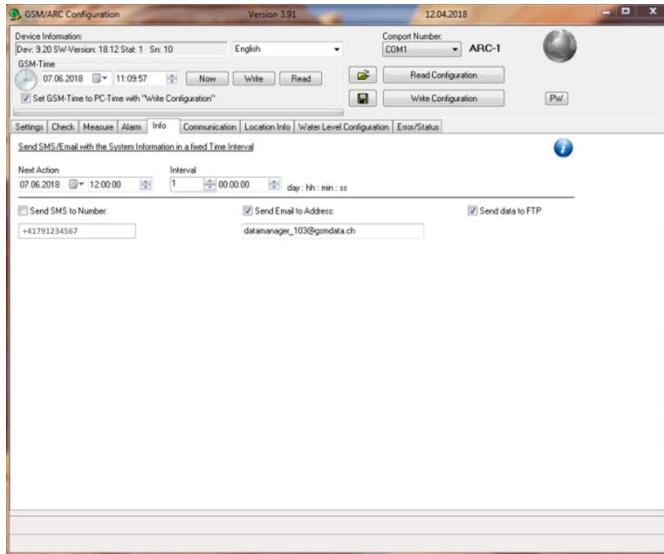
Since we now the last measurement time “07.06.2018 13:00:02”, the interval of “5 min” and the collected measurements “12” we know the time of the first measurement:

-> 07.06.2018 12:00:02 (first measurement)

Attention: With this setting no measurement data will be stored in the EEPROM (Record).



5.4 Info "#F/b"



Info message

Settings: From the 07.06.2018 12:00:00 each day

Sent to:

Settings: FTP and E-Mail



+41774692307 M

ARC_SN10 [gsm_103@gsmdata.ch]

At: datamanager_103

#f/b=0#T/s=581680905/p=18.06.07,12:00:45+08#M/a=-0.0187846+0.9448106+25.881958+0.9635600+26.690000/c=+1+1/d=-0.0187846+0.9448106+OFL+OFL+25.881958+OFL+0.9635600+26.690000+0.0001529+0.0001529#l/n=10/s=14/b=99/e=9.20/f=18.12/h=48/v=+3.879#A/a=gpr.s.wisscom.ch/b=gprs/c=gprs/d=000.000.000.000/e=ARC_SN10/f=gsm_103@gsmdata.ch/g=XXXXX/h=gsm_103@gsmdata.ch/i=XXXXX/j=pop.gsmdata.ch/k=995/l=smtp.gsmdata.ch/m=465/n=gsm_103@gsmdata.ch#b/a=datamanager_103@gsmdata.ch/b=datamanager_103@gsmdata.ch/c=datamanager_103@gsmdata.ch/g=Keller/j=/k=/m=+41791234567/n=+41791234567/q=+41791234567/r=Keller Entwicklung/s=+41774692307/t=ARC 10/u=MEASURE ARC SN10/v=ALARM ARC SN10/w=CHECK ARC SN10/0=8.7475439/1=47.4984244/2=450.000/3=0.000000/4=0.000000/5=0.000000#C/a=581681100/b=581681100/c=581767200/d=581695200/e=553182000/g=300/h=300/i=86400/j=86400/k=86400/m=211/n=0/o=3/p=0/q=12/r=1/s=1/t=2/v=6/w=4/x=8/y=15/z=112/0=0/1=3/2=0/3=0/4=4/5=12/6=5/7=0/8=1/9=0/A=0/B=1#f/a=553182000/g=86400/h=86400/m=1/n=0/o=20/q=12/z=14/3=0#d/a=+4.0000000/b=+3.0000000/c=+0.5000000/f=+1.0000000/g=+1.0000000/i=+0.0000000/j=+0.0000000/k=+0.0000000/m=+1.0000000/n=+50.000000/o=+450.00000/p=+0.0000000/q=+998.20001/r=+1.0000000/s=+0.0000000/t=+0.0000000/u=+0.0000000/v=+0.0000000/w=+0.0000000/x=+8.7475442/1=+47.498424/2=+450.00000#k/a=ftp.gsmdata.ch/b=datamanager_103@gsmdata.ch/c=XXXXX/d=ARC_SN10/e=21/f=21/g=0/h=ARC_Database#E/e

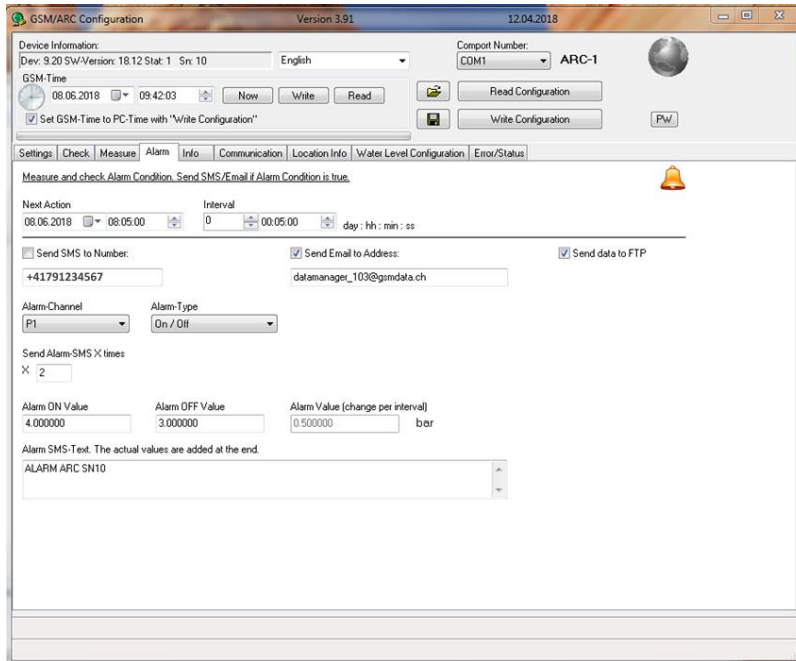
5.4.1.1 Example of the structure

#f/b=0#T/s=581680905/p=18.06.07,12:00:45+08#M/a=-0.0187846+0.9448106+25.881958+0.9635600+26.690000/c=+1+1/d=-0.0187846+0.9448106+OFL+OFL+25.881958+OFL+0.9635600+26.690000+0.0001529+0.0001529#l/n=10/s=14/b=99/e=9.20/f=18.12/h=48/v=+3.879#A/a=gpr.s.wisscom.ch/b=gprs/c=gprs/d=000.000.000.000/e=ARC_SN10/f=gsm_103@gsmdata.ch/g=XXXXX/h=gsm_103@gsmdata.ch/i=XXXXX/j=pop.gsmdata.ch/k=995/l=smtp.gsmdata.ch/m=465/n=gsm_103@gsmdata.ch#b/a=datamanager_103@gsmdata.ch/b=datamanager_103@gsmdata.ch/c=datamanager_103@gsmdata.ch/g=Keller/j=/k=/m=+41791234567/n=+41791234567/q=+41791234567/r=Keller Entwicklung/s=+41774692307/t=ARC 10/u=MEASURE ARC SN10/v=ALARM ARC SN10/w=CHECK ARC SN10/0=8.7475439/1=47.4984244/2=450.000/3=0.000000/4=0.000000/5=0.000000#C/a=581681100/b=581681100/c=581767200/d=581695200/e=553182000/g=300/h=300/i=86400/j=86400/k=86400/m=211/n=0/o=3/p=0/q=12/r=1/s=1/t=2/v=6/w=4/x=8/y=15/z=112/0=0/1=3/2=0/3=0/4=4/5=12/6=5/7=0/8=1/9=0/A=0/B=1#f/a=553182000/g=86400/h=86400/m=1/n=0/o=20/q=12/z=14/3=0#d/a=+4.0000000/b=+3.0000000/c=+0.5000000/f=+1.0000000/g=+1.0000000/i=+0.0000000/j=+0.0000000/k=+0.0000000/m=+1.0000000/n=+50.000000/o=+450.00000/p=+0.0000000/q=+998.20001/r=+1.0000000/s=+0.0000000/t=+0.0000000/u=+0.0000000/v=+0.0000000/w=+0.0000000/x=+8.7475442/1=+47.498424/2=+450.00000#k/a=ftp.gsmdata.ch/b=datamanager_103@gsmdata.ch/c=XXXXX/d=ARC_SN10/e=21/f=21/g=0/h=ARC_Database#E/e

The data contains all the different settings which are made with the Configuration tool.



5.5 Alarm “#F/c”



Alarm interval

Settings: 5 min

(The alarm condition will be checked every 5 min and if the condition gets true an alarm message will be send immediately)

Alarm channel / Alarm type:

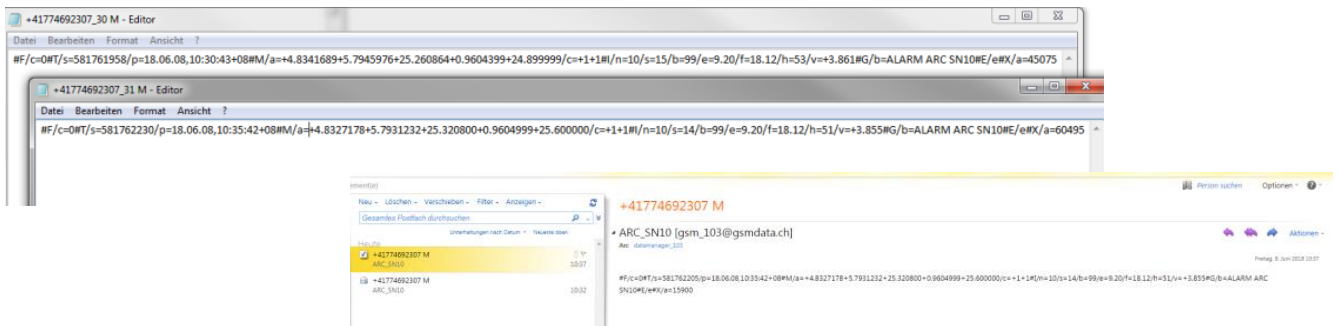
Settings: P1, On/Off

(Defines the channel and the type of the alarm)

Send Alarm X times:

Settings: 2

(The alarm messages are limited to two even the condition is still true. If the condition gets false again it will be reset)



5.5.1.1 Example of the structure

#F/c=0#T/s=581761958/p=18.06.08,10:30:43+08#M/a=+4.8341689+5.7945976+25.260864+0.9604399+24.899999/c=+1+1#I/n=10/s=15/b=99/e=9.20/f=18.12/h=53/v=+3.861#G/b=ALARM ARC SN10#E/e#X/a=45075

The alarm message contains the time information (Main time, Provider time), the activated channels in “plain text” format, the device information, as well as a user defined text.

Attention: This measurement data will not be stored in the EEPROM (Record).

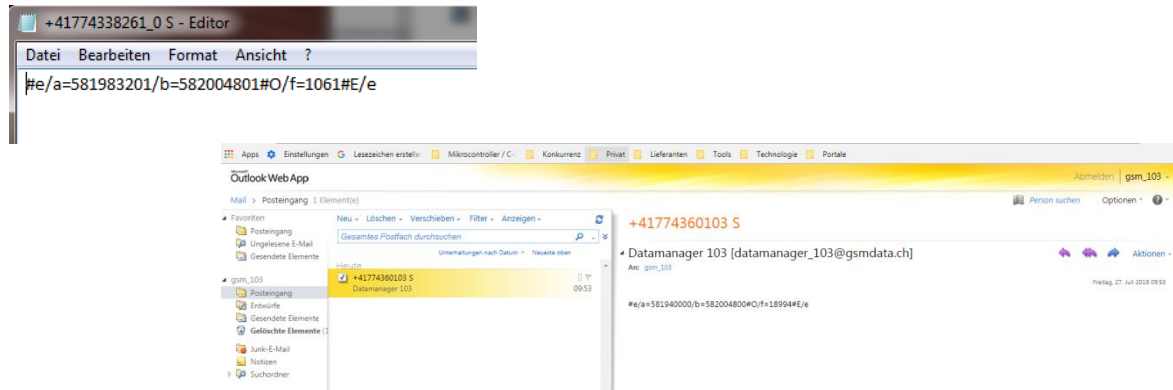


5.6 Check “#F/d” / “#F/f” / “#F/g”

5.6.1 Request missing Record data

Get the missing Record data from the 10.06.2018 22:00:01 till the 11.06.2018 04:00:01

5.6.1.1 Message to the ARC-1



5.6.1.1.1 Example of the structure

#e/a=581983201/b=582004801#O/f=1061#E/e

5.6.1.2 Message from the ARC-1

First, all stored measurement data will be sent (#F/e). After that the ARC-1 is looking for a measurement entry before the 10.06.2018 22:00:01 and after the 11.06.2018 04:00:01. It will collect the data and send up to 30 messages (#F/f). Finally, the current configuration is sent (#F/d).

5.6.1.2.1 Example of the structure

```
#F/e=0#C/a=6685/b=4#T/s=582201072/p=18.06.13,12:30:40+08#M/a=--
0.9621284+0.0001628+25.224365+0.9622900+24.870000+0.1000419/c=+1+1#I/n=10/s=18/b=95/e=9.20/f=18.12/h=33/v=+3.852#B/a=Vili
s6Z2AAAav3Y4EDkqkBBx3tgP3ZDcEHEoA49zOLwAAEsAL92ORA5LVAQcfrYD92RHBxBxOGAPc0z/////1YilrOozgAAAL92QxA5LcxAQcgkYD92T
nBBxqOAPc2r8AABLAC/dkgQOTQmQEHIJWmA/dlNwQcZrGd3Ng/86vsxWliKzqyYAAAC/dkcQOSB8QEHIeGA/dlFwQcY9gD3Ng/AAASwAv3ZE
Dk6BEBByh9gP3ZQcEHGZoA9zav/vJbzVilis61+AAAav3ZMEDkwrEBByNgP3XZcEHGoA49zVvwAAEsAL92ThA5Kr5AQcnLYD92WHBxBvWAPczi
/////w=#E/e#X/a=44474
```

```
#F/f=0#C/a=6325/b=30#T/s=582201080/p=18.06.13,12:30:40+08#I/n=10/s=18/b=95/e=9.20/f=18.12/h=33/v=+3.852#O/g=1061#B/a=Vilis
Fq2AAAav3XqEdkCEBB0etgP3XzcEHRwoA9zQrAAEsAL917xA5BtRAQdHrYD91+HBB0cKAPczi/z92wYilrBdDgAAAL919A5BThAQdGXyD91
/nBB0vWAPc0K8AABLAC/dfQOQmQEHr62A/dfxwQdJRgD3NcV86cQJWliKwX2YAAAC/dfsQOPvoQEHQ7mA/dgNwQdIUgD3Ng/AAASwAv
3X2EDkAFkBB0bJgP3X+cEHR64A9zTP/////VilisGG+AAAav3X6EDkFEBB0ZdgP3YcEHR14A9zQrAAEsAL91+xA5BMZAQdHrYD92A3BB0cKA
PC2D/////1YilrBkfgAAAL919BA5BShAQdFeYD91/HBB0ZmAPc1b8AABLAC/dfMQOPpYQEHQ7mA/dftwQdGzGd3Mkv86gotWliKwZm4AAAC/
dfYQOPpMQEHRXmA/df5wQdGfGd3Ng/AAASwAv3X2EDkiokBB0bJgP3X+cEHRcIA9zTP/vKK1VilisGjGAAAav3XxEdkDBkBB0bJgP3X5cEHRXIA
9zavwAAEsAL919RA5AerAQdFeYD91/XBB0VvAPczi/////1YilrBrHgAAAL919hA4/jBAQdFCYD91/nBB0UeAPc2r8AABLAC/dfUQOPrgQEHQt2A/
df1wQdEzGd3NW/8/dtFWliKwBYAAAC/dfkQOPvUQEHQ0mA/dgFwQdEzGd3NcVAAASwAv3X7EDkAOEBB0V5gP3YDcEHRHoA9zTP/OrTBVili
sG/OAAAav3X3EDki2kBB0xpgP3YAcEHRHoA9zGrwAAEsAL91+BA5ArJAQdEnYD92AHBB0QqAPcyS/////1YilrByJgAAAL918RA4+eBAQdEKYD9
1+HBB0PWAPcyS8AABLAC/dewQOP+IQEHRCmA/dfRwQd1gD3Mav/////9WliKwD4AAAC/de4QOQAUQEHRCmA/dfZwQd1gD3Ng/AAASw
Av3X0EDj+nEBB0JpgP3X8cEHQ4YA9zTP/OlzsVilisHbWAAAav3X2EDjplEBB0GJgP3X9cEHQzIA9zLrwAAEsAL919hA5BNRAQdFCYD91/nBB0LiAP
c1b/7yZQFYilrB5LgAAAL918xA46JBAQdBFYD91+nBB0gCAPc0z8AABLAC/de8QOQCSQEHQ7mA/dfZwQdFcgD3Muv/////9WliKw4YAAAC/de0
QOQGWQEHQ7mA/dfVwQdEegD3MuvAAASwAv3XvEDkEPkBB0NjgP3X3cEHQ9YA9zOL/P3bVilisH3eAAAav3XsEdkEsEBB0UJgP3X0cEHQzIA
9y/LwAAEsAL916xA5AHRAQdCaYD9183BB0MyAPcx/zqCi1YilrCANgAAAL915BA5BEZAQdEKYD917HBB0KQAPcxg8AABLAC/deMQOQciQEH
Q0mA/detwQdCjgD3Mav/////9WliKwgo4AAAC/delQOPToQEHQDmA/delwQdB6gD3MkvAAASwAv3XFEDkE5kBB0JpgP3XncEHQeoA9zEL/////
VilisTmAAAav3XbEDkHEBB0JpgP3XjCEHQZoA9zJLwAAEsAL912RA5Au5AQdDSYD914nBB0GaAPcyS/zo0wVYilrCHPgAAAL912BA479RAQdA
qYD914HBB0FGAPcy68AABLAC/ddoQOOWMQEHQDmA/deJwQdA9gD3MGv+8lbWliKwZYAAAC/dc8QOO7QQEHpUmA/dddWQdA9gD3MG
vAAASwAv3XREDkBEBB0EVgP3XZcEHQIA9zEL/////VilislvuAAAav3XREDj7OEBB0EVgP3XZcEHQFIA9zGrwAAEsAL91zhA49hBAQdBiYD911n
BB0BSAPcy6/z926YilrCORgAAAL91yhA499BAQc/yYD910nBB0ACAPcx8AABLAC/dcoQOPaYQEHQKmA/ddJwQc/rgD3Muv86XOXWliKw4A
AAC/dccQOP7IQEHQYmA/dc9wQc/rgD3MavAAASwAv3XEEDkd4EBB0GJgP3XNcEHP64A9zGr/////VilisJL2AAAav3XDEdjWEBBz0pgP3XkEH
P14A9zBrwAAEsAL91whA46GRAQc9YD91yXBBz8KAPcyS/////1YilrCVTgAAAL91whA49vxAQc+6YD91ynBB0QqAPcx8AABLAC/db4QOPo4QE
HPnWA/dcZwQdBmgD3M4v86DJWliKwL6YAAAC/dbkQOOZQEHPSmA/dcbWQdAogD3MavAAASwAv3WzEDj6QEBBz4FgP3W7cEHP14A9zE
L/vKF+VilisJn+AAAav3WtEDj+uEBBz9VgP3W1cEHP14A9zOLwAAEsAL91rhA4/MhAQc/yYD91tnBBz8KAPcwa/////1YilrCvGAAAL91sRA484xA
Qc+BYD91uXBBz66APcy68AABLAC/da8QOQF6QEHpNWA/dbdwQc+ZgD3Mkv8/dwFwliKwnq4AAAC/dbiQOQJQEHpNWA/dbpwQc+FGD3M
QvAAASwAv3W2EDj5eEBBz2VgP3W9cEHPHYA9zBr/Olzs#E/e#X/a=49389
```



F/f=0#C/a=6355/b=8#T/s=582201089/p=18.06.13,12:30:40+08#l/n=10/s=18/b=95/e=9.20/f=18.12/h=33/v=+3.852#O/g=1061#B/a=VilisKE
GAAAav3W9EDJzSEBBzy1gP3XEcEHPclA9zGrwAAEsAL91vhA5B5BAQdAOYD91x3BBz1yAPcOK////1YilrCjXgAAAL91wBA463BAQc9KYD91yHB
Bz1yAPcy68AABLAC/dbwQOPUgQEHPsmA/dcRwQc9HgD3MQv////9WliKwbpYAAAC/db4QOPyWQEHPgWA/dcVwQc8zgD3MQvAAASwAv3
W5EDj71EBBz2VgP3XBcEHPM4A9zBr/OcjXVilisKgOAAAav3W2EDKCGEBBz4FgP3W+cEHPHoA9zLrwAAEsAL91uhA48mBAQc8SYD91wnBBzw
qAPcvy/7yXDFYilrCqZgAAAL91txA48XBAQc71YD91v3BBzwqAPc0z8AABLAC/dasQOQLcQEHP1WA/dbNwQc71gD3Muv////9WliKwrl4AAAC/
daUQOom4QEHO9WA/daxwQc71gD3MkvAAASwAv3WIEDKfEABB0A5gP3WtcEHO4YA9zJL/P3cVvilisK8WAAAav3WhEDjzAEBBzy1gP3WpcE
HOzIA9zLrwAAEsAL91mhA49UxAQc71YD91onBBzsyAPcxq/zpl1YilrCxbgAAAL91xA5BBZAQc9IYD91n3BBz+uAPcxq8AABLAC/dZgQOP0sQE
OvWA/daBwQc9cgD3Mkv////8=#E/e#X/a=47373

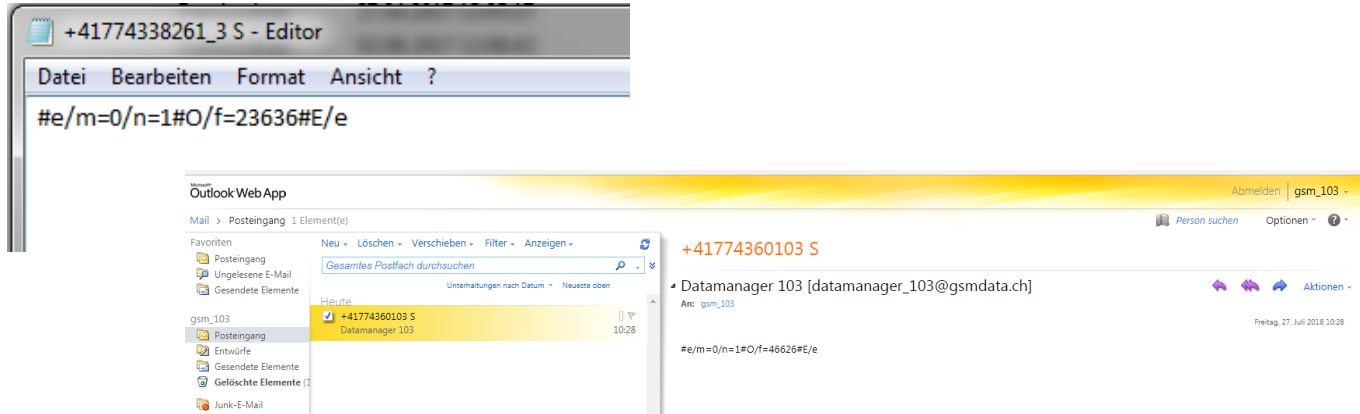
#F/d=0#T/s=582201095/p=18.06.13,12:30:40+08#M/a=+OFL+OFL+OFL+OFL+OFL+OFL/c=+0+0/d=+OFL+OFL+OFL+OFL+OFL+OFL+OFL+
OFL+OFL#l/n=10/s=18/b=95/e=9.20/f=18.12/h=33/v=+3.852#a/a=gprs.swisscom.ch/b=gprs/c=gprs/d=000.000.000.000/e=ARC147/f=gsm_
103@gsmdata.ch/g=XXXX/h=gsm_103@gsmdata.ch/i=XXXX/j=pop.mail-ch.ch/k=995/l=smtp.mail-
ch.ch/m=465/n=gsm_103@gsmdata.ch#b/a=datamanager_103@gsmdata.ch/b=datamanager_103@gsmdata.ch/c=datamanager_103@gsm
data.ch/g=XXXX/j=9821/k=/m=+41791234567/n=+41791234567/o=+41791234567/q=+41794999000/r=Keller
Entwicklung/s=+41774338261/t=ARC 10/u=This is a MEASURE message from ARC-1/v=Thus is a ALARM message from ARC-1/w=Check-
Message/0=8.7475439/1=47.4984244/2=450.000/3=8.746532/4=47.500267/5=0#c/a=582201300/b=631148400/c=582631200/d=5822874
00/e=631148400/g=300/h=86400/i=604800/j=86400/k=86400/m=211/n=0/o=1/p=1/q=12/r=4/s=1/t=2/v=6/w=4/x=8/y=13/z=40/0=1/1=3/
2=0/3=0/4=4/5=12/6=5/7=0/8=0/9=0/A=0/B=1#f/a=631148400/g=86400/h=86400/m=1/n=1/o=20/q=24/z=15/3=1#d/a=+32.000000/b=+2
9.000000/c=+0.5000000/f=+1.0000000/g=+1.0000000/j=+0.0000000/k=+0.0000000/l=+0.0000000/m=+0.0000000/n=+50.000000/o=+400.
00000/p=+0.0000000/q=+998.20001/r=+1.0000000/s=+0.0000000/t=+0.0000000/u=+0.0000000/v=+0.0000000/w=+0.0000000/x=+8.7475
442/1=+47.498424/2=+450.00000#k/a=ftp.gsmdata.ch/b=datamanager_103@gsmdata.ch/c=XXXX/d=ARC147/e=21/f=21/g=0/h=ARC_Dat
abase#O/g=1061#E/e



5.6.2 Get "Error" Report

Get an "Error" report from the ARC-1

5.6.2.1 Message to the ARC-1



5.6.2.1.1 Example of the structure

#e/m=0/n=1#O/f=46626#E/e

5.6.2.2 Message from the ARC-1

First, all stored measurement data will be sent (#F/e). After that the ARC-1 is looking for the "ERROR" report. It will collect the data and send up to 30 messages (#F/g). Finally, the current configuration is sent (#F/d).

5.6.2.2.1 Example of the structure

```
#F/g=0#C/m=2582/n=30/o=2000/p=3999#T/s=585996971/p=18.07.27,10:55:58+08#/n=10/s=17/b=99/e=9.20/f=18.12/h=40/v=+3.679#O/
g=46626#R/a=74,982,+CME ERROR: 606
$582834690,174,983,
+CME ERROR: 606
$582838288,174,984,
+CME ERROR: 606
$582838288,174,985,
+CME ERROR: 606
$582845489,174,990,
+CME ERROR: 606
$582845489,174,991,
+CME ERROR: 606
$582845490,174,992,
+CME ERROR: 606
$582849087,174,993,
+CME ERROR: 606
$582849088,174,994,
+CME ERROR: 606
$582849088,174,995,
+CME ERROR: 606
$582852688,174,996,
+CME ERROR: 606
$582852689,174,997,
+CME ERROR: 606
$582852689,174,998,
$582892302,174,1030,
+CME ERROR: 606
$582892302,174,1031,
+CME ERROR: 606
#E/e#X/a=46353
```



#F/d=0#T/s=585996978/p=18.07.27,10:55:58+08#M/a+=OFL+OFL+OFL+OFL+OFL/c+=+0+0/d+=OFL+OFL+OFL+OFL+OFL+OFL+OFL+OFL+OFL+OFL+OFL#I/n=10/s=17/b=99/e=9.20/f=18.12/h=40/v+=+3.679#a/a=gprs.swisscom.ch/b=gprs/c=gprs/d=000.000.000.000/e=ARC_SN10/f=gsm_103@gsmdata.ch/g=XXXXX/h=gsm_103@gsmdata.ch/i=XXXXX/j=pop.gsmdata.ch/k=995/l=smtg.gsmdata.ch/m=465/n=gsm_103@gsmdata.ch/h#b/a=datamanager_103@gsmdata.ch/b=datamanager_103@gsmdata.ch/c=datamanager_103@gsmdata.ch/g=Keller/j=/k=/m+=+41791234567/n+=+41791234567/o+=+41791234567/q+=+41794999000/r=Keller Entwicklung/s+=+41774692307/t=ARC 10/u=MEASURE ARC SN10/v=ALARM ARC SN10/w=CHECK ARC

SN10/0=8.7475439/1=47.4984244/2=450.000/3=0.0000000/4=0.0000000/5=0.0000000#c/a=581763900/b=581763900/c=581767200/d=586083300/e=553182000/g=300/h=300/i=86400/j=86400/k=86400/m=211/n=0/o=3/p=0/q=12/r=1/s=1/t=2/v=6/w=4/x=8/y=8/z=96/0=0/1=3/2=0/3=0/4=4/5=12/6=5/7=0/8=1/9=0/A=0/B=1#f/a=553182000/g=86400/h=86400/m=1/n=1/o=20/q=12/z=15/3=0#d/a+=+4.0000000/b+=+3.0000000/c+=+0.5000000/f+=+1.0000000/g+=+1.0000000/i+=+0.0000000/j+=+0.0000000/k+=+0.0000000/m+=+1.0000000/n+=+50.0000000/o+=+450.000000/p+=+0.0000000/q+=+998.20001/r+=+1.0000000/s+=+0.0000000/t+=+0.0000000/u+=+0.0000000/v+=+0.0000000/w+=+0.0000000/0+=+8.7475442/1+=+47.498424/2+=+450.00000#k/a=ftp.gsmdata.ch/b=datamanager_103@gsmdata.ch/c=XXXXX/d=ARC_SN10/e=21/f=21/g=0/h=A RC_Database#O/g=46626#E/e



6 DEVICE TYPE OVERVIEW

| Type | Description | Channels |
|------|--|--|
| 0 | RS485 (Bus address: 250) | 1: P _D (P ₁ -P ₂) [bar] 2: P ₁ [bar] 3: P ₂ [bar] 4: T [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] |
| 1 | RS485 & 2 Dig.Inp (Bus address: 250) | 1: P _D (P ₁ -P ₂) [bar] 2: P ₁ [bar] 3: P ₂ [bar] 4: T [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] |
| 2 | RS485 & Baro (P ₁ -P ₂) & Dig.Inp.1 (Bus address: 250) | 1: P _D (P ₁ -P ₂) [bar] 2: P ₁ [bar] 3: P ₂ [bar] 4: T [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] 7: P _{BARO} [bar] 8: T _{BARO} [°C] |
| 3 | RS485 & Baro (P ₁ -P _{BARO}) & Dig.Inp.1 (Bus address: 250) | 1: P _D (P ₁ -P _{BARO}) [bar] 2: P ₁ [bar] 3: P ₂ [bar] 4: T [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] 7: P _{BARO} [bar] 8: T _{BARO} [°C] |
| 4 | RS485 & Baro (P ₁ -P ₂) & Dig.Inp.1 & Volt Inp. (Bus address: 250) | 1: P _D (P ₁ -P ₂) [bar] 2: P ₁ [bar] 3: P ₂ [bar] 4: T [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] 7: P _{BARO} [bar] 8: T _{BARO} [°C] 9: Volt. Inp. 1 [V] 10: Volt Inp. 2 [V] |
| 5 | RS485 & Baro (P ₁ -P _{BARO}) & Dig.Inp.1 & Volt Inp. (Bus address: 250) | 1: P _D (P ₁ -P _{BARO}) [bar] 2: P ₁ [bar] 3: P ₂ [bar] 4: T [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] 7: P _{BARO} [bar] 8: T _{BARO} [°C] 9: Volt. Inp. 1 [V] 10: Volt Inp. 2 [V] |
| 6 | RS485(x5) & Baro (P ₁ -P ₂) & Dig.Inp1 / 2 = Counter Inp. & Volt Inp. (Bus address: 1,2,3,4,5) * The <u>state</u> of both digital inputs (0 or 1) | 1: P _D (P ₁ -P ₂) (1) [bar] 2: P ₁ (1) [bar] 3: P ₂ (1) [bar] 4: T (1) [°C] 5: TOB ₁ (1) [°C] |



| | | |
|-----------|--|--|
| | <p>is transmitted as plain text (#M/a= .../c=+1+1) in addition to the counter input number which is transmitted in plain text and additional, as record in base64</p> | <p>6: TOB₂ (1) [°C] 7: P_{BARO} [bar] 8: T_{BARO} [°C] 9: Volt. Inp. 1 [V] 10: Volt Inp. 2 [V] 11: P₁ (2) [bar] 12: P₁ (3) [bar] 13: P₁ (4) [bar] 14: P₁ (5) [bar] 15: Counter Input [dimensionless]*</p> |
| 7 | <p>SDI-12 & Baro & Digital Inp.1 & Volt Inp (Bus address: 0)</p> | <p>1: not used 2: P_{BARO} [bar] 3: T_{BARO} [°C] 4: Volt Inp.1 [V] 5: Volt Inp.2 [V] 6: SDI-12 CH1 [dimensionless] 7: SDI-12 CH2 [dimensionless] 8: SDI-12 CH3 [dimensionless] 9: SDI-12 CH4 [dimensionless] 10: SDI-12 CH5 [dimensionless] 11: SDI-12 CH6 [dimensionless] 12: SDI-12 CH7 [dimensionless] 13: SDI-12 CH8 [dimensionless] 14: SDI-12 CH9 [dimensionless] 15: SDI-12 CH10 [dimensionless]</p> |
| 8 | <p>RS485 (5xP₁+TOB₁) & Baro & Dig.Inp. 1/2 (Bus address: 1,2,3,4,5)</p> <p>* The <u>state</u> of both digital inputs (0 or 1) is transmitted as plain text (#M/a= .../c=+1+1) in addition to the counter input number which is transmitted in plain text and additional, as record in base64</p> | <p>1: P₁ (1) [bar] 2: TOB₁ (1) [°C] 3: P₁ (2) [bar] 4: TOB₁ (2) [°C] 5: P₁ (3) [bar] 6: TOB₁ (3) [°C] 7: P₁ (4) [bar] 8: TOB₁ (4) [°C] 9: P₁ (5) [bar] 10: TOB₁ (5) [°C] 11: Volt Inp.1 [V] 12: Volt Inp.2 [V] 13: P_{BARO} [bar] 14: T_{BARO} [°C] 15: Counter Input [dimensionless]*</p> |
| 9 | <p>RS485 CTD & Baro (P₁-P₂) & Dig.Inp. 1 & Volt. Inp. (Bus address: 250)</p> | <p>1: P_D (P₁-P₂) [bar] 2: P₁ [bar] 3: P₂ [bar] 4: T (Conductivity) [°C] 5: TOB₁ [°C] 6: TOB₂ [°C] 7: P_{BARO} [bar] 8: T_{BARO} [°C] 9: Volt Inp.1 [V] 10: Volt Inp.2 [V] 11: Conductivity T_c [$\frac{mS}{cm^2}$] 12: Conductivity raw [$\frac{mS}{cm^2}$]</p> |
| 10 | <p>RS485 CTD & Baro (P₁-P_{BARO}) & Dig.Inp. 1 & Volt. Inp. (Bus address: 250)</p> | <p>1: P_D (P₁-P_{BARO}) [bar] 2: P₁ [bar] 3: P₂ [bar]</p> |



| | | |
|-----------|--|---|
| | | 4: T (Conductivity) [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] 7: P _{BARO} [bar] 8: T _{BARO} [°C] 9: Volt Inp.1 [V] 10: Volt Inp.2 [V] 11: Conductivity T _c [$\frac{mS}{cm^2}$] 12: Conductivity raw [$\frac{mS}{cm^2}$] |
| 11 | RS485 CTD & Baro (3x (P ₁ + TOB ₁ + Cond T _c + Tcon)) & Baro & Counter Inp (Firmware Version >= 18.09) (Bus address: 1,2,3) | 1: P ₁ (1) [bar] 2: TOB ₁ (1)[°C] 3: Conductivity T _c (1) [$\frac{mS}{cm^2}$] 4: T (Conductivity) [°C] (1) 5: P ₁ (2) [bar] 6: TOB ₁ (2)[°C] 7: Conductivity T _c (2) [$\frac{mS}{cm^2}$] 8: T (Conductivity) [°C] (2) 9: P ₁ (3) [bar] 10: TOB ₁ (3)[°C] 11: Conductivity T _c (3) [$\frac{mS}{cm^2}$] 12: T (Conductivity) [°C] (3) 13: P _{BARO} [bar] 8: T _{BARO} [°C] 15: Counter input [dimensionless]* |
| 12 | RS485 & Baro (P ₁ -P _{BARO}) & Modbus ABB Aquamaster (Firmware Version >= 18.09) (Bus address: 250) | 1: P _D (P ₁ -P _{BARO}) [bar] 2: P ₁ [bar] 3: P ₂ [bar] 4: T (Conductivity) [°C] 5: TOB ₁ [°C] 6: TOB ₂ [°C] 7: P _{BARO} [bar] 8: T _{BARO} [°C] 9: Volt. Input 1 10: Volt Input 2 11: Flow Rate 12: Pressure 13: Custom Total Flow Units 14: External Supply Voltage 15: Counter Input |



7 DECODING BASE64

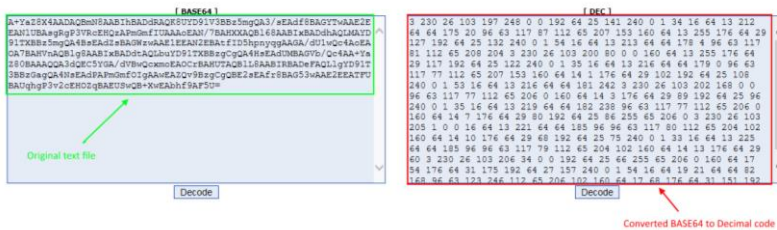
7.1 Example Measurement file (record activated):

#F/e=0#C/a=2347/b=5#T/s=443010632/p=14.01.14,11:31:02+04#M/a+=2.2168779+5.7929690+0.9582375+25.549998+2.2195887+2.4568239+2.3946847/c=+1+1#l/n=1935/s=14/b=22/f=12.40/v=+4.189

#B/a=A+YaZ8X4AADAQBmN8AABiHBADdRAQK8UYD91V3BBz5mgQA3/sEAdf8BAGYTWAEEZEEAN1UBAsgRgP3VRcEHQzAPmGmfIUAAAEAN/7BAHXXAQB168AABixBADdhaQLMAYD91TXBBz5mgQA4BsEAdZsBAGWzWAAE1EEAN2EBATfID5hpnYqgAAGA/dU1wQc4AoEAOA7BAHVnAQBlg8AABixBADdTAQLbuYD91TXBBzGcgQA4HsEAdUMBAGVb/Qc4AA+YaZ80BAAAQQA3dQC5YGA/dVbwQcxmoEAOcRBAHUTAQBIL8AABIRBADeFAQLlgYD91T3BbzGagQA4NsEAdPAPmGmfOlGAawEAZQv9BzGcgQBE2sEAfr8BAG53wAAE2EEATFUBAUqhgp3v2cEHOZqBAEUswQB+XwEAbhf9AF5U=#E/e#X/a=780

7.2 Converted BASE64 (green) to Decimal (red) code:

Put that string into a BASE64 to Decimal converter, as one on the web page: <https://conv.darkbyte.ru/>



Please note: be aware that no spaces, carriage return or line feed are copied into the window

7.3 Interpretation:

Header (consists of 7 Bytes)

3 230 26 103 197 248 0 0

start pointer record : Byte0 = 3 = 00000011, Byte1 = 230 = 11100110, start pointer = 0001111100110

start pointer absolute time [s] from 01.01.2000 = $2^{24} \cdot \text{Byte1} + 2^{16} \cdot \text{Byte2} + 2^8 \cdot \text{Byte3} + \text{Byte4}$
= $(26 \cdot 16777216) + (103 \cdot 65536) + (197 \cdot 256) + 248 = 443008504$ seconds from 01.01.2000
= 10:56:05 / 14.01.2014

First data package (consists of 4 Bytes)

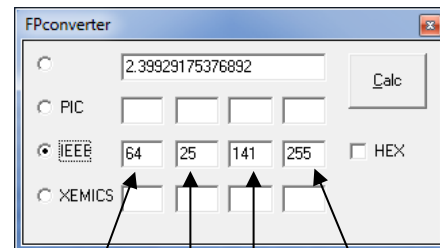
192 64 25 141

Byte0 = 192 = 11000000

= selected channel = 1100 = 12

Converting Bytes to IEEE754 (Byte0 = 255 (default))

Measuring value of channel 12 = 2.399291



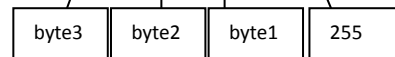
Second data package (consists of 4 Bytes)

240 0 1 34

Byte0 = 240 = 11110000

When Byte0 = 240 = 11110000 then data package

Information is about data packet time delay



Data package time delay (to last data package) = $2^{16} \cdot \text{Byte3}(0) + 2^8 \cdot \text{Byte2}(1) + \text{Byte3}(34) = 290$ seconds (4min 50s) =

End of record or empty data package

255 0-15-7

Byte0 = 255 = 11111111 = represents empty package or end of record.

Byte1 + Byte2 + Byte3 getting ignored. A new record starts always on a new page.



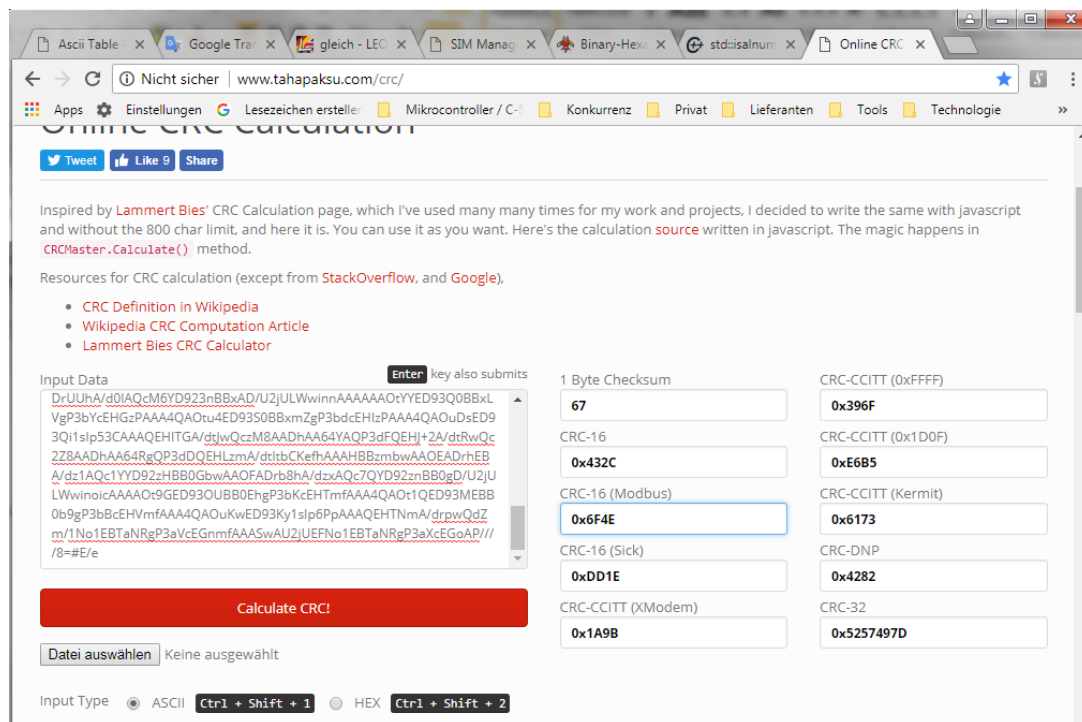
8 CRC16

Example:

```
#F/e=0#C/a=3538/b=17#T/s=580816908/p=18.05.28,12:01:11+08#M/a=+0.0000000+0.0000000+0.0000000+0.9637399+26.900000/c=+0
+0#I/n=4187/s=21/b=99/f=16.51/v=+3.882#B/a=LWwing2QAAAAOt68ED93g0BByddgP3cTcEHMAPAAAAQAOTpYED93ek8BBycVgP3cNcEH
MAPAAAAUAOUQAED93gC1slp4UmQAAQEHs2A/dw5wQczM8AADhAA640YQP3d/QEHJ2A/dw1wQcwA8AADgWA63xIQP3d4QEHIJfWA/
dwktbCKeG6AAAHBBByzPwAAOEADrZehA/d3tAQcIZYD93D3BBY5nwAAOEADrgVhA/d3dAQck1YD93BnBBysz/U2jULWwiniYtAAAAOtmsE
D93cEBByO5gP3cEcEHKzPAAA4MAOUtCED93cUBBYO5gP3b/cEHKAPAAA4QAOT/UED93aC1slp4tNAAQEH3GA/dvhwQcPm8AADhAA64
bwQP3dRQEHIT2A/dvpwQcmZ8AADhAA61wwQP3ddQEHIJfWA/dvEtbCKeNDwAAHBByszWAAOFADrjyBA/d19AQciCYD927XBBymbwAAO
DADrVRhA/d1xAQchdYD928XBBysz/U2jULWwinj7IAAAAOuM+ED93X0BBYDpgP3bucEHKAPAAA4UAOUgQED93Y0BBYDpgP3bzCEHKAPA
AA4IAOtyWED93W51slp5FzwAAQEHPmA/dutwQcbM8AADhgA6zCwQP3dOQEHEW2A/dudwQcIA8AADgWA6zDgQP3dOQEHBvmA/duc
tbCKeTNgAAHBByszWAAOEADrBNhA/d05AQb/oYD927XBBYDwAAODADrHjHA/d1RAQb8zYD928HBBvZn/U2jULWwinldkAAAAOsQ8ED9
3Tk8BvzNgP3bscEG+zPAAA4MAOsfgED93U0BBv6BgP3bvcEG/M/AAA4YA0StuED93Xi1slp5ebQAAQEHADWA/dvhwQcBm8AADgWA6zRw
QP3daQEHA02A/dvNwQcGZ8AADgWA61JgQP3dZQEHBvWA/du8tbCKeZXMAAHBBWgDwAAOGADrOvhA/d1JAQcJhYD926nBBwzPwAAO
DADrUUhA/d0IAQcM6YD923nBBxAD/U2jULWwinnAAAAAOTYED93Q0BBxLVgP3bYcEHGzPAAA4QAOTu4ED93S0BBxmZgP3bdcEHIZPA
AA4QAOUdsED93Qi1slp53CAAAQEHITGA/dtJwQczM8AADhAA64YAQP3dFQEHJ+2A/dtRwQcZ28AADhAA64RgQP3dDQEHlzmA/dtltbCKe
fhaAAHBBzmbwAAOEADrhEBA/dz1AQc1YYD92zHBB0GbwAAOFADrb8hA/dzxAQc7QYD92znBB0gD/U2jULWwinoicAAAAOT9GED93OUB
B0EhgP3bKcEHTmfAAA4QAOT1QED93MEBB0b9gP3bBcEHVmfAAA4QAOUkWed93Ky1slp6PpAAAQEHNTmA/drpwQdZm/1No1EBTaNRgP
3aVcEGnmfAAASwAU2jUEFN01EBTaNRgP3aXcEGoAP///8=#E/e#X/a=28494
```

Calculate CRC:

Insert the whole message except the "#X/a=28494" in the CRC calculation tool
([HTTP://WWW.TAHAPAKSU.COM/CRC/](http://www.tahapaksu.com/crc/))



Convert the CRC-16 Modbus to Decimal: 0x6F4E => 28494



9 REVISION HISTORY

| Version | Datum | Verfasser | Änderungsbeschreibung |
|---------|------------|-----------------------|-----------------------|
| 1.00a | 24.05.2018 | Pascal Schlegel (SPa) | Create document |

Tabelle 1: Revision history