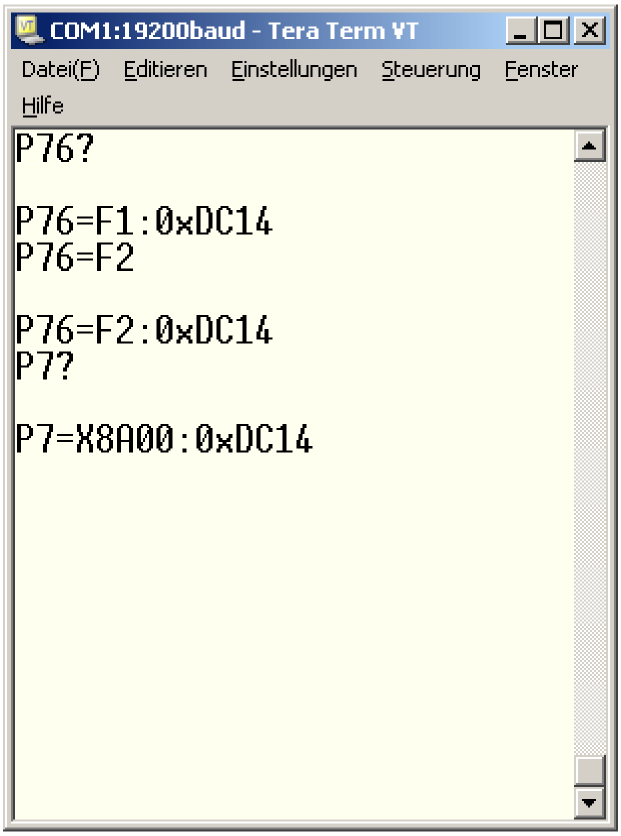
Applies to FTC200, FTC220, FTC200-OEM, FTC300

Remote Control
via Serial Communication



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1. Introduction

The configuration of the device is defined by about 170 parameters. Using programs for serial communication like e.g. Tera Term the user has access to these values. For the operation direct access to these parameters by the user is neither necessary nor advised, since they are updated by menu controlled procedures like e.g. calibration when necessary.
It is strongly recommended to use menu controlled procedures via the control panel of the FTC300 or SetApp when reconfiguring the device. Controlled procedures prevent handling errors.

- Chapter 2 describes the syntax of read- and write-commands using two innocuous parameters as examples. Reading bitmasks parameters is explained at the example of status and error byte.
- Chapter 3 contains a collection of examples.
- The list of parameters, their valid range, unit and meaning is included in the shipment.

✎ Read this manual and the manual of the device carefully before performing any action described in this manual.

✎ Information on the installation of the RS232 interface and the necessary PC settings are given in the manual of the device.

Caution!
Any inexpert change of the parameters might cause a fatal failure or damage the instrument. Messkonzept will deny any warranty claims due to improper settings of the parameters.

Caution!
All parameter numbers in this manual refer to software version 1.028. Parameter numbers may be different for other software versions.

2. Command Syntax

2.1 Read and Write Commands

The setting of the device is defined by a set of parameters. The list of parameters is enclosed in the delivery. Each parameter is addressed by its number written in first column.

2.1.1 Read Command

A simple example is the query of the value of a parameter. Parameter 0 “P0” contains the measured gas concentration in ppm, a question mark indicates a query, and hence the string “P0?” followed by CR command queries the measured gas concentration. The answer is a string containing the questioned parameter, its value and a system status byte, for example “P0=F1.2005e+04:0xC804”.

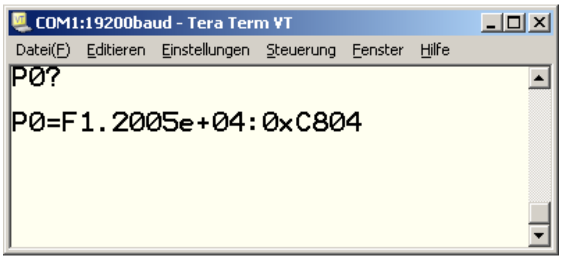


Figure 2.0 Screenshot from Tera Term: reading the concentration in units of ppm

queried parameter	float - type of following value	value, here 12005 ppm	separator	hexadecimal- type of following value	status byte
P0=	F	1.2005e+04	:	0x	C804

Table 2.1 Syntax of a returned value

A modified read command, with“N” replacing “?” returns the name of the parameter instead of its value. The query “P0N” returns
“P0= Compound ppm:0xC804”

A query following the example above can be applied to all parameters. Some of the parameters are “read-only”, abbreviated with “RO” in the list. Those parameters contain values that are measured by the device and are not suited for modification. The other “read-write” parameters, abbreviated “RW” can be modified by writing a different value to the parameter.

2.1.2 Write Command

The write command is explained at the example of setting of the digital precision in the display of the FTC300. “P76” determines the number of digits after the decimal point when display shows Vol. %. The command “P76=F2” followed by CR sets the number of digits to two and a measuring value is displayed like “23.84 Vol. %”. After execution of the command the device returns “P76=F2:0x1C04”, the syntax is the same as the response to a query of that parameter.

✎ Please note that parameter numbers are different for software version 1.014 and older.

✎ The parameters have only two different types, float (F) and hexadecimal (0x). Floats are also used for numbers of integer values, for example the number of digits in the example above.

✎ The internal update cycle of the device demands for polling frequencies below 5Hz.

✎ Terminal settings: new line/send: CR+LF, local echo

2.2 Bitmask Parameters

Some of the parameters contain bitmasks, for example "P4" (system status) and "P6" (system error). In the example given above the status byte is "0x1C04". The prefix "0x" indicates that this is a hexadecimal value. For a better understanding the four hexadecimal figures are converted to binary numbers. Every hexadecimal figure is represented by 4 binary figures, see table below. Every binary figure is assigns to one status attribute, altering between "0" for attribute not set and "1" for attribute set.

Example: "P4" (system status) is "0x1C04"

0x	1				C				0				4			
binary	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0
description	Error	Alarm	Error in serial	Relay 1 active during	Relay 2 active during	Relay 3 active during	digital input on +24V	digital output is active			System is in warmup	Alarm 2	Alarm 1	Temperature control		
0x status	0x8000	0x4000	0x2000	0x1000	0x0800	0x0400	0x0200	0x0100	0x0080	0x0040	0x0020	0x0010	0x0008	0x0004	0x0002	0x0001

Example: "P5" (system setup) is "0x0490"

0x	0				4				9				0			
binary	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0
description						Relay 3 active is failsafe	Relay 3 is frozen during	Unit is in percent	Relay 1 active is failsafe	Relay 1 is frozen during		Relay 2 active is failsafe	Relay 2 is frozen during		Control loop is cal frozen	
0x status	0x8000	0x4000	0x2000	0x1000	0x0800	0x0400	0x0200	0x0100	0x0080	0x0040	0x0020	0x0010	0x0008	0x0004	0x0002	0x0001

Example: “P6 ” (system error) is “0x8A00”, same for “P7” (last system error) and “P8”(alarm mask)

0x	8				A				0				0			
binary	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
description	Relay 1 on	Relay 2 on	External error	TC max error	TC min error	BU max error	BU min error	BT max error	BT min error			unstable signal during	Calib. exceeds limit with resp.	Calibration offset error	Calibration gain error	EEPROM error
0x Error	0x8000	0x4000	0x2000	0x1000	0x0800	0x0400	0x0200	0x0100	0x0080	0x0040	0x0020	0x0010	0x0008	0x0004	0x0002	0x0001

3. Specific Applications

3.1 Triggering of Internal Routines/"Special Action" Command

P39 is able to trigger the execution of internal routines, which gives it an exceptional position among the RW parameters. Setting parameter P39 to a certain value leads to the execution of one of the routines in the table below. After processing a routine P39 is automatically set back to "0".

Command	Executed Procedure
P39=F0	Do nothing
P39=F1	Restart System
P39=F2	Reset to factory settings
P39=F3	Reset to default settings
P39=F4	Set temperature control OFF
P39=F5	Set temperature control ON
P39=F6	Set alarms "ACTIVE OFF"
P39=F7	Set alarms "ACTIVE ON"
P39=F8	Set relay 1 ON
P39=F9	Set relay 1 OFF
P39=F10	Set relay 2 ON
P39=F11	Set relay 2 OFF
P39=F12	Set relay 3 ON
P39=F13	Set relay 3 OFF
P39=F21	Calculate and save "CALIBRATION OFFSET GAS"
P39=F22	Calculate and save "CALIBRATION GAIN GAS"
P39=F50	Load all parameter values from hidden FLASH-RAM
P39=F51	Save all parameter values to hidden FLASH-RAM

Table 3.0 Actions triggered by P39

3.1.1 Calibration Routine

General Information on Calibration

Messkonzept uses gases with the following purities for calibration:

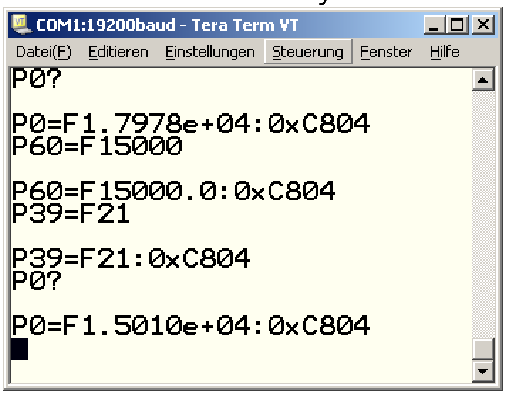
H_2	He	N_2	Ar	O_2	CO_2	CH_4
5.0	5.0	5.0	4.6	4.5	4.5	4.5

The gas purities are selected such that the devices comply with the specifications for the smallest measuring range. Messkonzept recommends gases of same purity for calibration on-site. For differing requirements of one's own, opt for an appropriate gas purity. Please contact us for advice.

We recommend a calibration, resp. a check of the calibration if one of the following criteria is met:

- After bringing into service
- On a regular cycle, depending on the precision aimed for. To find out the appropriate time between calibrations, we recommend to begin with a more frequent check of the calibration. The time between calibrations can range between
  -several month for a measuring task in the Vol.% range
  -days to weeks for a measuring task in the sub-Vol.% range
  -to directly before every measurement if highest accuracy is needed
- When the situation of the measurement regarding pressure or gas flow changes in case an extreme change in ambient temperature occurs.

Performing an offset calibration entails the parameters P60 and P39. First, the concentration of the gas in the mixture used for the offset-calibration has to be written in ppm to P60. After the gas of that concentration has been applied to the device for a sufficient time the offset calibration can be started by the command “P39=F21” followed by the ASCII CR command.
In an analogous manner the gain calibration can be made.
The concentration of the gas used for the gain-calibration has to be written to P61. After the gas of that concentration has been applied to the device for a sufficient time the gain calibration can be started by the command “P39=F22” followed by the ASCII CR command.



P0?: user asks for concentration in ppm

Answer: value of P0 (before calibration)
P60: set offset calibration gas to 15000ppm

Answer: P60 set to requested value
P39: Start offset calibration
--- Wait for about 10 seconds for answer---
Answer: Offset calibration done (here:“P39=F21:C804”)
P0?: user asks for concentration in ppm

Answer: value of P0 (after calibration)

Figure 3.1 Screenshot from Tera Term: Offset Calibration

Note!
Always do an offset calibration first before doing a gain calibration!
Often an offset calibration alone is sufficient for a proper performance of the device.

Note!
Please keep in mind that after starting the calibration the respond of the instrument takes approximately 10 seconds. During a calibration the averaging period is set to 10 seconds automatically in order to minimize the absolute error of measurement.

3.2 Changing the Measured Gas Mixture

The measured gas mixture is written in parameter P77. The value of P77 ranges from 0 to 15 and every number corresponds to a certain gas mixture, see table below.
Example:
Sending "P77=F2" followed by CR will change the settings of the device for measuring He in N2. After executing the command the instrument returns the parameters new value and the status byte, for example"P77=F2:0x1C04".

Command Value	Gas mixture
P77=F0	H2 in N2
P77=F1	O2 in N2
P77=F2	He in N2
P77=F3	CO2 in N2
P77=F4	N2 in Ar
P77=F5	O2 in Ar
P77=F6	H2 in Ar
P77=F7	He in Ar
P77=F8	CO2 in Ar
P77=F9	Ar in CO2
P77=F10	CH4 in N2
P77=F11	CH4 in Ar
P77=F12	Ar in O2
P77=F13	N2 in H2
P77=F14	O2 in CO2
P77=F15	User Polynomial

Table 3.1 Gas mixtures in Multi Gas Mode

Note!
Only devices with Multi Gas Mode can perform this action.

3.3 Routeing of Internal Signals to Analog Output 1 and 2

The devices provide two additional 0 to 10V non-insulated analog outputs. The table below shows the parameters that can be routed to these outputs. The corresponding command value written to P143 (Aout1) routes this parameter to output 1, P146 (Aout2) routes a parameter to output 2.
Example:
“P143=F5” routes the block temperature to analog output 1.

Command Value	Executed Procedure
0	Nothing is routed to Aout1 or Aout2
1	P0 (Compound ppm) is routed to Aout1 or Aout2
2	P1 (Compound RAW) is routed to Aout1 or Aout2
3	P2 (Norm. Signal) is routed to Aout1 or Aout2
4	P3 (TC Average) is routed to Aout1 or Aout2
5	P53 (Block Temp.) is routed to Aout1 or Aout2
6	P133 (Aux ppm) is routed to Aout1 or Aout2
7	P134 (Aux Norm.) is routed to Aout1 or Aout2
8	P67 (IOut) is routed to Aout1 or Aout2

Table 3.2 Routeing to analog output 1 and 2

✎ **Careful!**
In software versions older than 1.014 other parameter numbers for the routeing to the analog outputs were used:
old: P153 (instead of P143 now)
old: P156 (instead of P146 now)

3.3.1 Calibration of the Analog Outputs

The parameter routed to AOut1/AOut2 has to be scaled such that it fits the 0 to 10 V output range. One set parameters is responsible for the modification of the routed parameter.

	Aout1	Aout2
Routed Parameter	P143	P146
Aout-Offset in Volts	P144	P147
Aout-Gain	P145	P148

Table 3.3 Parameters for configuration and calibration of the Analog outputs

The voltage output at Aout1 and Aout2 is calculated as follows:
The value of the routed parameter is x.
Output Voltage Aout1=x*P145+P144
Output Voltage Aout2=x*P148+P147

Example 1:
The block temperature measured in °C (parameter P53) is routed to Aout1 with the command"P143=F5".
A proper scaling is Aout1-Offset = 0 and Aout1-Gain=0.1 with the commands
"P144=F0" and "P145=F0.1"With this setting the default block temperature of 63°C result in an output voltage of 6.3V

Example 2:
The measured concentration in ppm (parameter P0) is routed to Aout1. For possible concentrations from 0 to 10^6 pmm a proper scaling is P144=0 and P145=0.00001. 0V at 0 ppm and 10V at 10^ 6ppm.

Example 3:
The measured concentration in ppm (parameter P0) is routed to Aout1. The range from 0 Vol.% to 10 Vol.% (0 ppm to 100`000 ppm) should correspond to 1V to 9V at Aout1. We use the equations above for the calculation of offset and gain.

Offset: 1 V = 0 ppm * P145 + P144
->The offset is 1V (command: "P144=F1")

Gain: 9 V = 100`000 ppm * P145+1 V
(9 V-1 V) / 100´000 ppm=P145
->The gain is 0,00008 (command: "P145=F0.00008")

The voltages at Aout1/Aout2 can exceed the value of 10V. For values exceeding this value the output stays 10.5V.