

Special Software Information Guide *to the **iokeys** - GST, Ground Station instrument.*

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Introduction

The **iokeys** compact load tension data recorders, STL-100KN, measure and record data, sensed with a built-in sensor. (For more details please visit the website: www.iokeys.com).

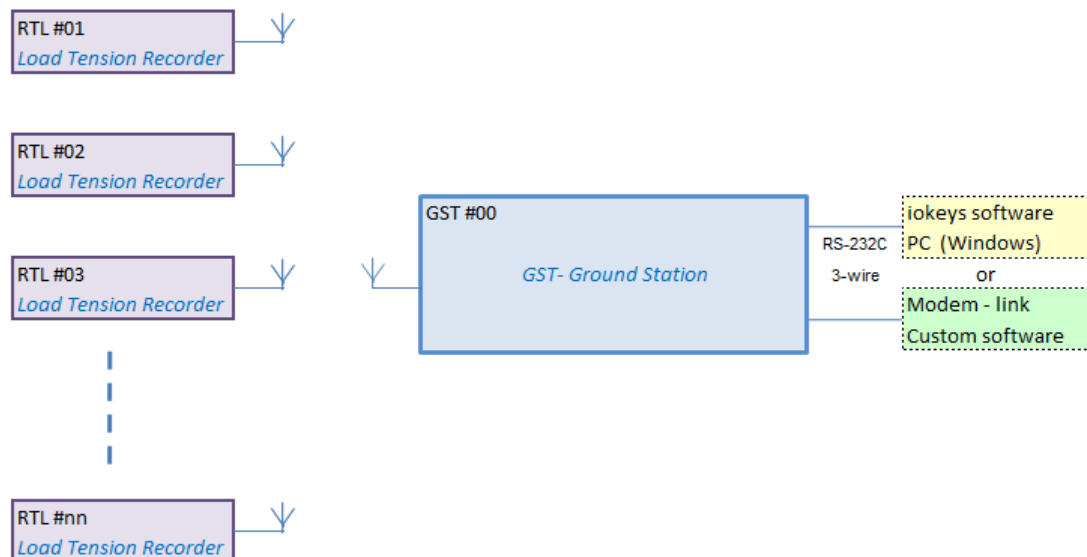


The STL-100KN load tension recorder, shown without the transceiver area.

The RTL-150KN is similar to the STL-100KN, but equipped with a transceiver.

The iokeys RTL-150KN has a built-in Radio Frequency (RF) transceiver. The transceiver range is estimated to be 600m. The transceiver communicates in the license free 2.4GHz frequency band.

A ground station unit with built-in transceiver, the **iokeys** - GST, is needed to communicate with the RTL-150KN load tension recorders. One Ground Station (GST) can communicate with up to 12 RTL-150KN instruments.



The **iokeys** - GST, "Ground Station", communicates automatically with the RTL-150KN instruments. Data from all the recorders in the system is also stored in the **iokeys** - GST at the end of each measurement interval.

The user can access all stored data by communication via modem or a similar link to the **iokeys** - GST. The data is stored in a ring buffer that has two million bytes. This enables the user to access all relevant data for more than 100days*.

*(5 recorders in a system, 20bytes from each recorder at the end of each interval (10min)).

How to communicate

All iokeys instruments can use the **iokeys.exe** program for communication with a computer running the Windows operating system. The computer (PC) **must** be equipped with one serial RS232 communications port (Com port).

The connector terminals are as follows (RS-232 signals).

[MS3102E14S-6S connector on the **iokeys** -GST]

pin A, Data Out

pin B, Data In

pin C, Ground

*pin D, Option for **iokeys** -GST, External Voltage Supply 3,6V,
Power supply for the GST, and enables the RS-232 transmission.*

pin E, (not connected)

pin F, (not connected)

The supplied communications software (iokeys.exe) does **not** include online data transmission.

If you plan to make your own custom communication software, then you need the following supplied information.

Communicating with the **iokeys** - GST Instrument

The communication speed is 9600BAUD [9600,8,N,1] 8 data bits, no parity and one stop bit.

Wake Up.

Use the character "**A**" to wake the recorder from sleep mode. You need to send the **A** character until an ">" or "?" is echoed.

The recorder can only accept commands when awake!

Reading Data, CV and CG commands

All data from the RTL-150KN instruments in the system is also stored in the **iokeys** - GST, ground station.

To retrieve data stored in the internal memory of the ground station, the following procedure should be used: Use single bytes, 56h for V, and no quotation marks.

First a memory bank (8192 bytes) is selected for read-out with the "**CV**" command. Then the "**CG**" command is sent.

Always wait for the "**C**" character to be echoed!

Send the "**V**" command (echoed V) and then the binary code to select the memory bank that is to be read.

Example:

CV(00bin) [*two bytes: 43 56 and 00*] for the first bank, then send the "**G**" to get this memory bank (8192 bytes),

CV(01bin) [*two bytes: 43 56 and 01*] for the second , then send the "**G**" to get this memory bank (8192 bytes) and so on until all relevant data has been read.

CV(FFbin) [*three bytes: 43 56 and FF*] for the last memory bank , then send the "**G**" to get this memory bank (8192 bytes) (top of ring buffer).

Note:

The RTL-150KN recorder measures the value from the tension load cell each second and finds the highest and the lowest value measured during the measurement interval, typically 10minutes.

Each recorded measurement at the end of the measurement interval is 6 bytes. (high value (1,5 bytes), low value (1,5 bytes) and mean value (3 bytes) for the measurement interval). A typical measurement interval is 10 minutes. All values are stored as "raw", i.e. no calculation on the values are performed in the instrument. Calibration of raw data is performed in a PC or a host computer using the calibration file info for each recorder.

Stored Data Records

Stored data records in the *iokeys* -GST from each recorder consists of the following information:

Serial No.:	3 bytes
Current time.:	4bytes
Time of first measurement.:	4 bytes
Measurement interval in seconds.	3 bytes
High/low values.	3 bytes
Mean sum of values.	3 bytes

Total 20 bytes

Each data block has a 30 byte header. Space for max 408 records of 20bytes and 2 bytes for block id, a total of 8192 bytes.

An example datafile will be provided later.

Data Calibration

Each recorder is supplied with a calibration file. The file contains constants for calculating the actual measured values in N or Kg.

The load cell sensor has a near linear transfer function. The following function is used for calculating the actual Newton or Kilogram values. $Y = A * X * X + B * X + C$ (A=0.0). The raw value X, stored by the recorder (and sent by the online transmission), has to be calculated with the supplied A, B and C constants.

Example:

Calibration file for MS-310SA no.:0A0115 A=0.0 B=4.995 C=-1202.7

Here the A constant is zero (linear transfer function of the load cell).

Get Instrument Information String, CJ command

256 characters sent in response to the "CJ" command (get info string).

```
00 00 49 4F 4B 45 59 53 00 00 54 48 03 01 00 00 00 0A 02 70 _
00 00 00 07 FE D8 rs tu yv 28 92 8C 2C 28 92 8C A4 00 02 58 ...
```

start1; (00)

start2; (00)

name1; (49) I

name2; (4F) O

name3; (4B) K

name4; (45) E

name5; (59) Y

name6; (53) S

type1; (00)

type2; (00)

type3; (53) "S"

type4; (41) "A"

type5; (01) "type number"

type6; (03) assembly-prog. version

ser1; (00)

ser2; (00)

ser3; (00)

ser4; (0B)

ser5; (ab)

ser6; (cd) Serial Number "0Babcd"

size1; (00) MSB memory size in bytes

size2; (00)

size3; (00)

size4; (07)

size5; (FE)

size6; (D8) LSB

mesu1; (rs) MSB number of measurements

mesu2; (tu)

mesu3; (yv) LSB

time1; (28) MSB Current time in seconds

time2; (92)

time3; (8C)

time4; (2C) LSB

fst1; (28) MSB Time of first measurement in seconds

fst2; (92)

fst3; (8C)

fst4; (A4) LSB (example: current time + 120 seconds)

per1; (00) MSB Measurement interval in seconds

per2; (02)

per3; (58) LSB

The rest of the string contains information on internal functions.

Load New Settings to **iokeys** - *GST*, **CB** command

The “CB” command is used to enter new operational parameters into the recorder. These operational parameters are:

Current time information [range: FFFFFFFFhexadecimal] [Red letters]
 Time of first measurement [range: FFFFFFFFhexadecimal] [Blue letters]
 Measurement interval [range: FFFFhexadecimal] [Green letters]

The time, First measurement time and Measurement interval are based on seconds.

Any timebase can be used (the iokeys instruments use the 1st of January 1984 at 00:00:00, as the zero time).

The current time is incremented every second.

The time range is (FFFFFFFhexadecimal) 4294964295 seconds. ca. 136 years

The communication and display software should convert the seconds values to the following values for easy readout: **year, month, day, hours, minutes and seconds**

An example of the string is given below:

time1; (28) MSB Current time in seconds
 time2; (92)
 time3; (8C)
 time4; (2C) LSB

fst1; (28) MSB Time of first measurement in seconds
 fst2; (92)
 fst3; (8C)
 fst4; (A4) LSB (example: current time + 120 seconds)

per1; (00) MSB Measurement interval in seconds
 per2; (02)
 per3; (58) LSB

The communication software should transmit one byte at a time and listen for an echo of that byte. If there is no echo, then the byte should be resent in a few milliseconds.

An example of the transmission (through the RS-232 port) is:

C(C)B(B)2(2)8(8)9(9)2(2)8(8)C(C)2(2)C(C)2(2)8(8)9(9)2(2)8(8)C(C)A(A)4(4)0(0)0(0)0(0)2(2)5(5)8(8)

The green characters are the echoed characters.

(Transmission in ASCII format : B is sent as “42”, 2 as “32” and so on).

A total of 22 characters are needed to fill the string, after the “B” command. If less than 22 characters are supplied, the recorder waits until more are supplied.

NOTE:

in ASCII format If the “B” command is echoed with an (*), then the recorder contains data that has not been retrieved. The data can be retrieved with the “G” command, as described above. Or if the data is of no value, then you can send the “L” command, which instructs the recorder that the data has been retrieved.

Special Attention for Custom Communication Software Design!

New parameters should be entered with caution!

If the first time is less than the current time, then the instrument never starts to store information!

So please insure that the first time is well in advance of the current time.

Command Character Summary for the **iokeys** - GST

Command character	ASCII Hex	Function Chr	ASCII Hex	9600BAUD communication speed, (9600,8,n,1), 8 data bits, no parity, one stop bit iokeys - GST	Send to iokeys - GST	Response / Comment
		A	41	Wake-up char	AAAAA.... (no ecco)	When awake, the response is "S" or "J"
				Each command and function character is echoed when awake		
C	43	B	42	Settings (20 bytes) received	C (ecco C) B (ecco B) C (ecco C) B (ecco *)	"*" is echoed if memory has unretrieved data.
C	43	G	47	Transmit data block	C (ecco C) G (ecco G)	8192 bytes (binary)
C	43	J	4A	Get string (256 bytes)	C (ecco C) J (ecco J)	256 bytes (binary) recorder info
C	43	L	4C	Data has been read	C (ecco C) L (ecco L)	"I" is sent
C	43	Q	51	Turn communication off	C (ecco C) Q (ecco Q)	none
C	43	R	52	Reset recorder (second character)	C (ecco C) R (ecco R) + (ecco +)	Reset recorder (initialize)
		+	2B	Reset recorder (third character)		
C	43	V	56	Bank select, set addr, start, stop, block	C (ecco C) V (ecco V)	send binary bytes with address to GST
		?	3F	Unrecognized command		
		*	2A	Unretrieved data in memory		
		>	3E	Wake		
		!	21	Memory is ready for new recordings, recorder has to be loaded with new settings.		

Retrieving the high and low values and the last mean value online.

The recorded values from the load tension recorders are also stored in the iokeys - GTS, Ground Station, for easy online access.

Wake up the iokeys - GST with the "A" character as described earlier.

Read the a memory bank containing the relevant data using the commands **CV** and **CG** see above.

Record data (one string 20bytes)

0B030134C4FE5F34C4DD3800001EFA00F6010D00

Serial No. value 0B0301

Time hexadecimal value 34C4FE5F

First Time hexadecimal value 34C4DD38

Interval hexadecimal value 00001E

High hexadecimal value "abc" is stored as "bca"

Low hexadecimal value "abc" is stored as "abc"

Mean hexadecimal value:

Mean value" **abcdef**" [001D00] is stored as: **bc ad ef** [010D00]

The mean value is found by dividing "abcdef" by the number of seconds in the measurement interval. Example: [00001Eh] = 30.

Example: 001D00h/001Eh = 00F7h or in desimal: 7424/30 = 247

Please note: The raw measurement hexadecimal values need to be converted to desimal values before real value calculation is performed, (using the constants in the calibration files).

Note on time values:

The time, First measurement time and Measurement interval are based on seconds.

The iokeys instruments use the 1st of January 1984 at 00:00:00, as the zero time.

For additional information,
please contact by email:

info@iokeys.com

Internet website: www.iokeys.com