FOGALE nanotech

Protocol for RIA 8µp Communication Frame

Description: Communication Mode between an RIA8.2 Frame and an RS-232 Communication Port

Goal:
Describe (1) the commands that permit communication with an RIA8.2 µp frame, and (2) the operating procedures for the device.

Means:
Communication is achieved through an RS-232 or RS-485 type serial port, depending on the distance between the frame and the PC.

Commands and Data:
The information circulating through the serial connection is hexadecimal, written in ASCII code.

Sample: STX 01F1OEETX

is in ASCII: $02_H\ 30_H\ 31_H\ 46_H\ 31_H\ 30_H\ 45_H\ 03_H$

General syntax of commands:

STX, address, command, data checksum, ETX

STX ASCII character 02 ➔ Beginning character
ETX ASCII character 03 ➔ in some cases ACK or NAK ASCII 06 or 15
End character

Address: Frame ID number, from 1 to 64 (01_H to 40_H) in an octet

Commands: in an octet

Data: according to the command

Checksum: checksum in one octet

Checksum verification: the sum of all the characters (except STX and ETX) plus the checksum (ones complement). The verification must equal zero.

Sample checksum calculation:

STX 01 E2 41 20 41 7B ETX
address data checksum

01+E2+41+20+41 = 185 ➔ only one octet is kept ➔ 85 ➔ 1000 0101

checksum=ones complement + 1 ➔ 1000 0101 ➔ 0111 1010
\+ 1
0111 1010 ➔ 7B

verification: 01+E2+41+20+41+7B= 200 in 2 octets ➔ but 00 for one octet

when the weak octet is 00 the message is valid.

List of Commands

F0 ***RESET FOR RIA 8 µp FRAME***

F1 ***RIA 8 µp FRAME CONNECTION***

F2 ***RIA 8 µp FRAME DISCONNECT***

31 ***RIA 8 µp FRAME INITIALIZATION***

30 ***ACQUISITION OF VALUES FOR RIA 8 µp FRAME***

00 ***ACQUISITION OF RIA 8 µp FRAME VOLTAGE IN REAL FORMAT***

F6 ***READING THE RIA 8 µp FRAME STATUS***

F7 ***REARMING SAFETY FOR THE RIA 8 µp FRAME***

03 ***CALIBRATION TYPE FOR RIA 8 µp FRAME***

10 ***DIGITAL INPUT FOR RIA 8 µp FRAME I/O***

11 ***DIGITAL OUTPUT FOR RIA 8 µp FRAME I/O***

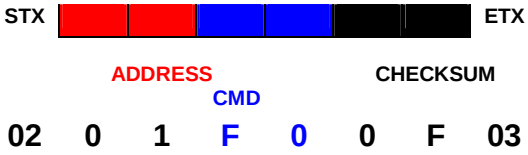
Description of Commands:

Introduction:

A sample line is given with each command. The 01 address was selected arbitrarily.

F0 RESET FOR RIA 8 µp FRAME

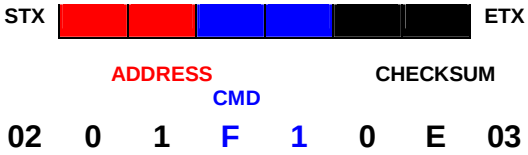
Allows the frame to be reset, for example when the program is booted up.



Response: No response. Expect to wait at least 300 ms after sending the command.

F1 RIA 8 µp FRAME CONNECTION

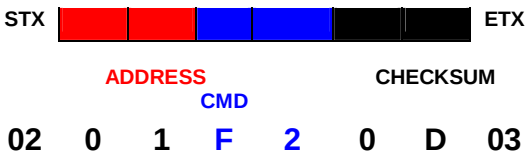
Initializes the frame and prepares it to receive commands.



Response: ACK. 100 ms is required to receive the response. This wait time is due to the relay connection.

F2 RIA 8 µp FRAME DISCONNECT

Stops the frame from receiving commands but does not cut the daisy chain if more than one frame is being used.



Response: No response.

31 INITIALIZATION of ACQUISITION PARAMETERS for RIA 8 µp FRAME

Allows one to send the acquisition parameters, sample numbers, mean, response time.
NOTE: The acquisition command is ***30***.

02 0 1 3 1 03

CC: number of "instantaneous" acquisitions
PPPP: Acquisitions every PPPP interruptions (x20ms)
This parameter gives the response time for the acquisition.
Overall T = PPPP x 20ms
MMMM: number of samples in the running average

Condition:

CC x MMMM <= 65535

<= is this an arrow or is it meant to be ≤ ?

Default value:

CC = 30
PPPP = 2
MMMM = 5

Response: ACK.

WARNING: We strongly advise you NOT to change these parameters. The values indicated are utilized for the certification of the RIA 8's µp circuit board. (Should any modification of these values be required, consult FOGALE Nanotech's technical department for assistance.)

30 ACQUISITION OF VALUES FOR RIA 8 µp FRAME

Command that asks the frame to send voltage values while specifying the number of the sensors as well as the status of the digital data.

02 0 1 3 0 0 2 C D 03

N: number of sensors

01 to 0A Sensors (0 to 10 two-track) only
11 to 1A Sensors (0 to 10 two-track) + I/O
0 ➔ I/O only

Response:

STX addr NE Sxxxxxxx ..... Sxxxxxxx IIII OOOO CS ETX

NE: N: Number of measurement tracks (1 track corresponds to 2 voltages)
E = 0 if the frame is OK and 1 if the frame experiences failure

Voltage **Sxxxxxxx**: Real 32 bits (4 octets) corresponding to one half-track
(to convert the voltage, see the calculation method provided at the end of this document)

Input Value **I I I I**: initial C1CO value (default output value)

When the response is received, it may be (for example): F043
One must first retrieve the weak reading (F0) and then the strong reading (43), making it 43F0.
This inversion is necessary because of the Intel microprocessor utilized in the RIA 8 µp frame's circuit board.

After the conversion, the word retrieved is made up of 16 bits: 2 bits per track, forming 8 digital tracks.

Because there are 2 bits per track, there can be 4 status conditions:
If the control valve command is used:

00 → actuator in motion
01 → actuator closed
10 → actuator open
11 → actuator not connected

Output Value **OOOO** : Initial Value 5555 (default output value)

When the command is encoded, it becomes, for example: 43F0 .
The weak value must come first (F0), then the strong value (43) of the command, which then becomes F043 .
This inversion is necessary because of the Intel microprocessor utilized in the RIA 8 µp frame's circuit board.

After the conversion, the word retrieved is made up of 16 bits: 2 bits per track, forming 8 digital tracks.

Because there are 2 bits per track, there can be 4 status conditions. But for the command, 2 status conditions are sufficient:

01 → closes actuator
10 → opens actuator

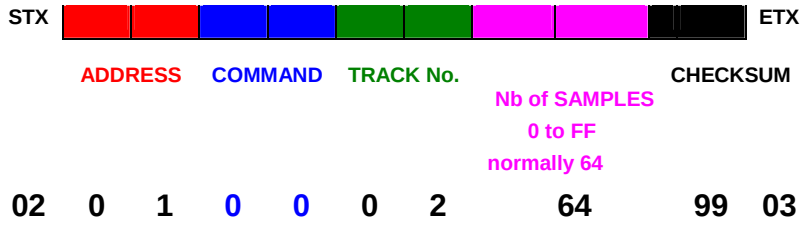
Value **NE**
If, for example, NE = 2
There are two measurement tracks (which means 4 voltages in the message):

S1xxxxxxxxx S2xxxxxxxxx S3xxxxxxxxx S4xxxxxxxxx

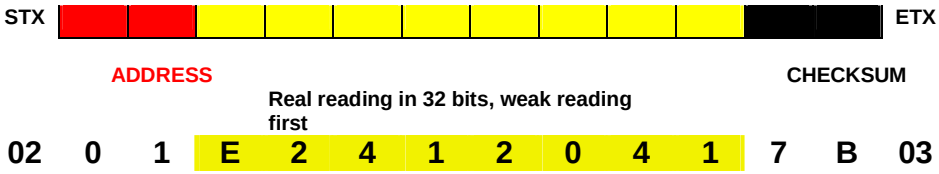
Values S1 and S2 correspond to track 1 of the frame, so S3 and S4 correspond to track 2.

00 ACQUISITION OF RIA 8 µp FRAME VOLTAGE IN REAL FORMAT

Reads the values of the sensors connected to the frame.



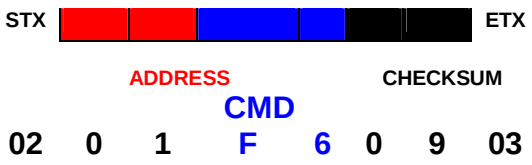
Response :



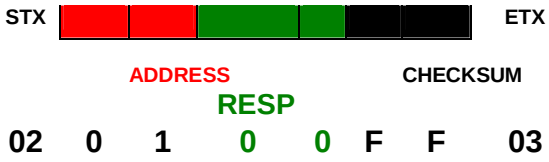
Note: This command is obsolete if the system is operating with Command ***30***

F6 READING THE RIA 8 µp FRAME STATUS

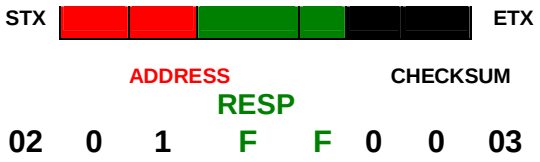
Reads the status of the frame. The frame may cut off power to the sensors for safety reasons (see RIA 8 µp frame manual); nevertheless, communication remains open.



Response (1st possibility): Frame is operating normally.



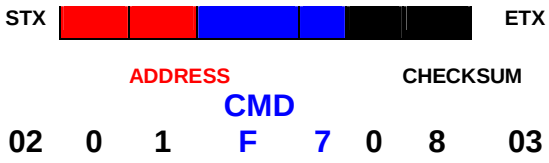
Response (2nd possibility) : the frame's safety system has been engaged and power has been cut off.



Note: This command is obsolete if the system is operating with Command ***30*** because this function is incorporated into that command.

F7 REARMING SAFETY FOR THE RIA 8 µp FRAME

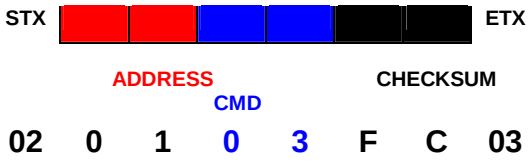
Resets the frame in normal operating condition (power to the sensors). This command should *not* be sent until one has checked, on site, the condition of the measurement system—check, in particular, the condition of the sensors.



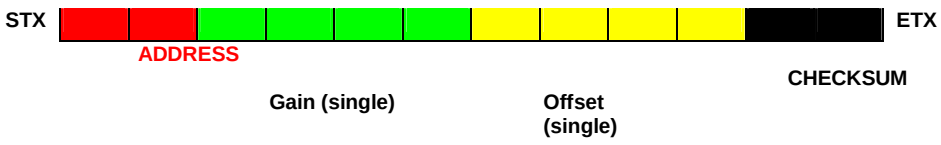
Response : No response.

03 CALIBRATION TYPE for RIA 8 µp FRAME

Tells the frame to calibrate itself according to its internal references. This command is obsolete if the system is operating with Command ***30***



Response : A wait of 300 ms is required after this command is sent in order to retrieve the correct response.

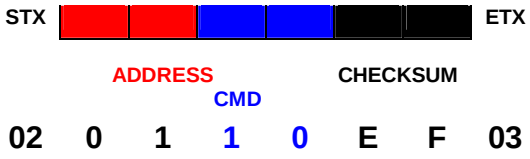


Note : This command is obsolete if the system is operating with Command ***30***

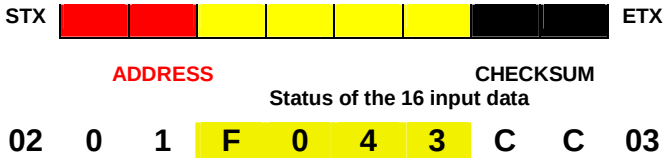
WARNING : This command may provoke a change in value with respect to the factory calibration of the RIA 8 µp frame.

10 DIGITAL INPUT for RIA 8 µp FRAME I/O

Reads the status of the digital input. This command only applies to a frame equipped with this option.



Response :



When the response is received, it may be for example : F043 .
One must take the weak reading first (F0), then the strong reading (43) of the command, making it 43F0 .

This inversion is necessary because of the Intel microprocessor utilized in the RIA 8 µp frame's circuit board.

After the conversion, the word retrieved is made up of 16 bits: 2 bits per track, forming 8 digital tracks.

Because there are 2 bits per track, there can be 4 status conditions:
If the control valve command is used:

01 → actuator in motion
01 → actuator closed
10 → actuator open
11 → actuator not connected

There must be a typo: 01 cannot mean two different things!

Note: This command is obsolete if the system is operating with Command ***30*** because this function is incorporated into that command.

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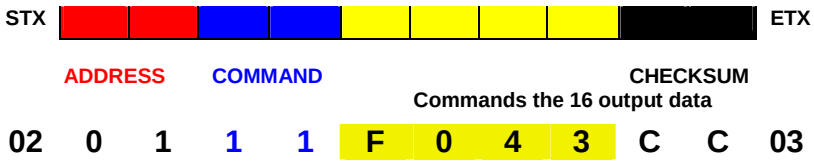
11 DIGITAL OUTPUT FOR RIA 8 µp FRAME I/O

Controls the digital output. This command only applies to a frame equipped with this option.



When one composes this command, one obtains, for example : 43F0
One must take the weak reading first (F0), then the strong reading (43) of the command, making it F043 .

This inversion is necessary because of the Intel microprocessor utilized in the RIA 8 µp frame's circuit board.

After the conversion, the word retrieved is made up of 16 bits: 2 bits per track, forming 8 digital tracks.

Because there are 2 bits per track, there can be 4 status conditions. But for the command, 2 status conditions are sufficient:

01 → closes actuator
10 → opens actuator

Note: This command is obsolete if the system is operating with Command ***30*** because this function is incorporated into that command.

Response:

Start-Up Procedure

To use the frame under normal operating conditions, *you must first initialize the system following this procedure*:

1/Initialization:

1 Send the RESET (***F0***) command.
2 Wait 1200 ms.
3 Send the CONNECTION (***F1***) command.
4 Wait 100ms.
5 Read the response.
6 Wait 100ms before sending any new command.

2/Initialization of Acquisition Parameters :

1 Send the INITIALIZATION of ACQUISITION PARAMETERS (***31***) command.
2 Wait 100ms.
3 Read the response.
4 Wait 100ms before sending any new command.

3/Acquisition of Voltages :

1 Send the ACQUISITION (***30***) command.
2 Wait for the response (approximately 15 ms).
3 Read the response.
4 Format the answer.
5 Detect any data acquisition block by checking for doubles (over a period of 20 seconds).
If blocking is found, repeat Initialization Procedures 1 and 2 above.

Procedures 1 et 2 are to be performed consecutively for the use of each frame (should there be more than one frame in the system).

Procedure 3 should be used in a loop in order to continuously monitor the voltage levels for the frame.

Calculation Method (Voltage -> Frame's HEX string)

This method the conversion of voltage readings into a string of characters that correspond to the string sent by the RIA frame.

Voltage = 6.426399708

Calculating the sign

Sign = 0

Calculating the exponent

Divide by 4 = 2^2 -> exponent = 2 exponent calculated = 127+2 = 129

Exp(dec) = 129
Exp(hex) = 81

Calculating the mantissa

R = 6.426399708 / 4 = 1.606599927
Remove the 1

R = 1.606599927 – 1 = 0.606599927

Multiply by 2^{23} = 8388608

R = 0.606599927 * 8388608 = 5088529

Convert R to Hexadecimal

R(dec) = 5088529

R(hex) = 4DA511

Recompose sign + exp + mantissa

	Sign	Exp	Mantissa
	1bit	8bits	23bits
Hex	0	8	1
Bin	0	1000	0001

Hexadecimal	4	D	A	5	1	1
Binary	0100	1011	1010	0401	0001	0001

	Sign	Exp	Mantissa					
	1bit	8bits	23bits = 32 bits					
Binary	0100	0000	1100	1011	1010	0401	0001	0001
hexadecimal	4	0	C	D	A	5	1	1

The string returned by the frame is a mirror of this hexadecimal string:
11A5CD40

When one has the RIA frame's output string, one has only to follow the procedure described above, but in the opposite order.