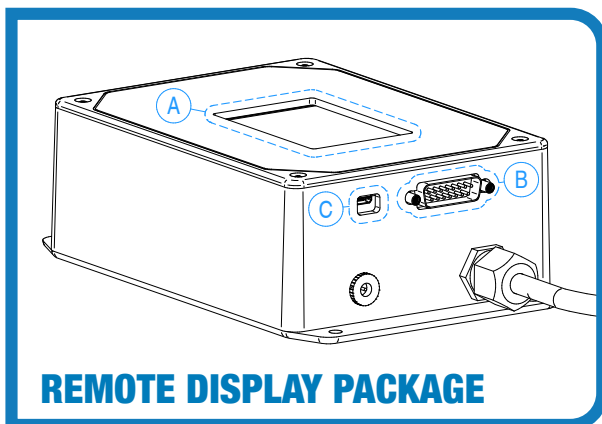
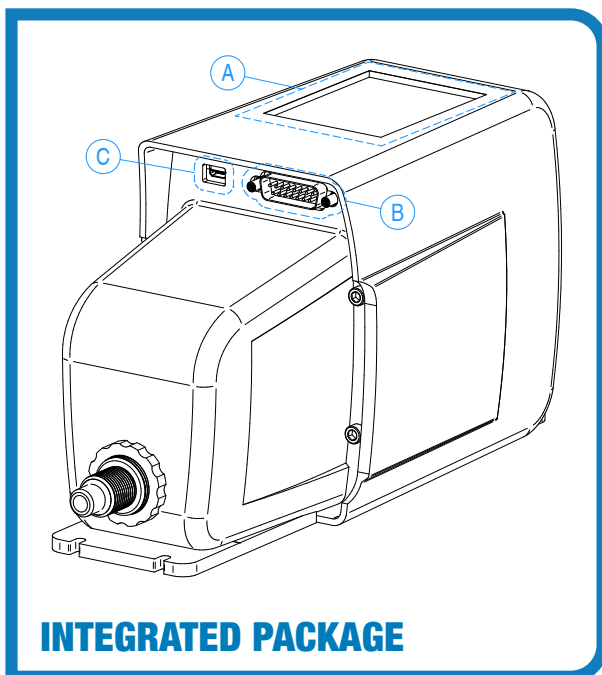


DIGITAL COMMUNICATIONS PROTOCOL SERIAL / RS485 API FOR IRIIDIUM FLOW CONTROLLER

ATTENTION! Read this manual completely before attempting to operate this product. Failure to do so may result in injury to you or damage to the device. Keep this document for future reference.



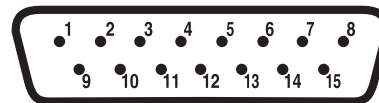
- A LCD TOUCH DISPLAY**
- B 15-PIN MALE D-SUB CONNECTOR**
- C USB 2.0 MICRO-A CONNECTOR**

ELECTRICAL CONNECTIONS

A 15-pin D-SUB connector provides all power and signal connections to the IRIIDIUM, with the exception of the USB port. Various adapters and hubs are available to adapt the connector to wiring terminals or other interfaces. Below you can find the IRIIDIUM's 15-pin wiring details.



CAUTION: MIS-WIRING THE FLOW CONTROLLER MAY CAUSE DAMAGE TO THE UNIT. PLEASE READ THE IRIIDIUM OPERATING MANUAL CAREFULLY!



PIN	FUNCTION
1	Power GRD
2	+24 VDC (Max Range +15 to +25)
3	Input Com*
4	Output Current*
5	Output Volt*
6	Alarm Out-A*
7	RS485-Pos
8	Power GND
9	Volt IN (from PIN 2)
10	Input-Volts*
11	Input-Currents*
12	Output Com*
13	Alarm Com*
14	Alarm Out-B*
15	RS485-Neg

*** INCLUDES ANALOG & ALARM OPTIONS**

KEY FUNCTIONS

Several key functions and settings can be controlled using serial commands. Either the USB micro connection or the RS485 connection may be used. See Menus “**Configuration – USB -xx**” or Menus “**Configuration – RS485 -xx**” to make appropriate choices.

ID

The “ID” on the RS485 configuration can be set to a number from 1 to 99, and this allows for communication to that specific IRIDIUM flow controller (for USB or RS485 communication). The ID provides for a unique address for each IRIDIUM.

You can enter the ID using the Touchscreen; Menu “**Configuration - RS485 – ID**” your choice.

This provides a unique address for each IRIDIUM that will be on the same serial loop. ID number can only be added from the Menu.

Example: If you have ID of “63” you can address that Flow Controller with the command **Set ID=63**

After that command you can communicate *only with that Flow Controller*, until you use the Set ID command for a different unit you wish to communicate with.

NOTE: COMMANDS ARE NOT CASE SENSITIVE.

ALARM

set AlarmAction=3 // Set the value
get AlarmAction // Read the value

COMMUNICATION PARAMETERS / SET COMMANDS

Communication parameters can be set on screen menu:

go to **MENU**
Configuration -- USB
 or **Configuration -- RS485**

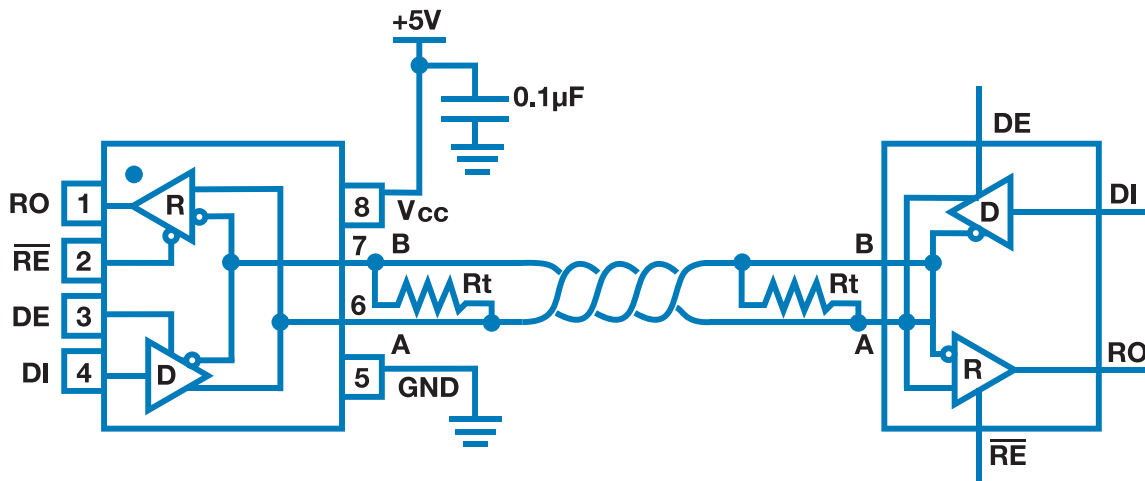
Set commands will respond back for most of the command set:

Example: **set FVCNTL=4**
 will return **variable = fvcntl value = 4**

This sets the Flow Controller into the standby mode. It is good to use the Standby Mode to prevent the Auto mode from opening the valve fully, as it unsuccessfully tries to restore the flow rate - when you are blocking flow with the External on-off dispense valve and thus preventing Auto control of the flowrate.

RS485

Iridium uses the MAX3060E from Analog Devices for hardware communication, below is a top view diagram.



API GUIDE

NOTE: Choose which of the 4 Alarms to use **FIRST** -> see command below AlarmNum

API GUIDE			
COMMANDS	RANGE	UNITS	NOTES
AlarmUnits	0 – Liters 1 – Milliliters 2 – Gallons (US) 3 – Fluid Ounces 4 – Grams 5 – Pounds 6 – Kilograms		Set alarmunits=1 Get alarmunits
AlarmTime	0 – Seconds 1 – Minutes 2 – Hours 3 – Days		
AlarmHSP		Microliters/minute	
AlarmLSP		Microliters/minute	
AlarmTotal		Microliters	
AlarmCondition	0 – Disable 1 – Above high set point 2 – Below low set point 3 – Between high and low set points 4 – Outside high and low set points 5 – Total 6 - Leak		
AlarmReset	0 – Never (Alarm must be reset manually) 1 – Not present 2 – One minute 3 – Five minutes 4 – Thirty minutes		
AlarmAction	0 – None 1 – Standby 2 – Relay A 3 – Relay B		
AlarmNum	[1-4]	Choose the Alarm #	Set alarmnum=3
NOTE: MUST CHOOSE THE SPECIFIC ONE OF THE 4 ALARMS FIRST BEFORE OTHER COMMANDS			
AnalogInputType	0 – Disabled 1 – 0 to 5 volts 2 – 0 to 10 volts 3 – 0 to 20 mA 4 – 4 to 20 mA		
AnalogOutputType	0 – Disabled 1 – 0 to 5 volts / 0-10 mA 2 – 0 to 10 volts/0-20 mA 4 – 4 to 20 mA		

API GUIDE			
COMMANDS	RANGE	UNITS	NOTES
FVCtrl	0 – Closed 1 – Open 2 – Auto 3 – Auto Standby 4 - Standby		Set FVNTL=4
MenuTimeout	10 – 10 seconds 30 – 30 seconds 60 – 1 minute 300 – 5 minutes -1 – Never		
NumPoints	[1-8]		
RelayA	0 – OFF 1 - ON		
RelayB	0 – OFF 1 - ON		
RelayAction	0 – Normal 1 - Inverse		
RelayEnable	0 – No 1 - Yes		
RelayNum	0 – Relay A 1 – Relay B		Choose RELAY first!
Setpoint			Set setpoint=432
SetpointSource	0 – Touchpad “DSP” 1 – Analog 2 – USB 3 – RS485		set setpointsource=1
Splashscreen	0 – McMillan Logo 1 – Log Screen		
TotalFlow			sets in microliters gets in current units
UOMUnits	0 – Liters 1 – Milliliters 2 – Gallons (US) 3 – Fluid Ounces 4 – Grams 5 – Pounds 7 – Kilograms		
UOMTimeInterval	0 – Seconds 1 – Minutes 2 – Hours 3 – Days		
ID			Set ID=44

VARIABLES

MENU RETURN TO MAIN SCREEN

This feature is user selected. After a period of time the screen may return to the main initial screen view. User can select under “DISPLAY OPTIONS” 10, 30, 60 seconds or NEVER. If “NEVER” is selected, the user must use the “HOME” button to return to the main screen view.

OPERATIONAL CONTROL MODE FVCTNL

On the main screen to the upper right side, below the flow rate bar, is the current selected operational mode. If AUTO is the selected mode, then full flow control is possible. In AUTO, the control valve will open or close the diaphragm valve so as to make the flow rate the same as the Setpoint.

The MODE is USER settable → Configuration / Modules / Flow Valve / Control Valve

OTHER MODES

“STBY” means Standby, so that valve is frozen in whatever current position may be and it will not move until taken out of this mode. In Standby, the flow controller is essentially a flow meter only (with some possible restriction at point of the valve, including no flow if completely closed).

Auto Standby is another user selectable choice that can place the flow controller into the frozen standby mode even when it is in AUTO mode. This interacts with the Setpoint – most users will not use this.

The Auto Standby MODE is USER settable → Configuration / Modules / Auto Standby

AUTO STANDBY

3%, 5%, or 7% of full scale means that IF the Setpoint is below the selected % flow level, then the valve will at that point be frozen in its current position and stay that way until the Setpoint changes to a level higher.

“OPEN” Mode means open... if you press the menu selection 2 times the motor will open valve to the maximum flow, 1 time is part open.

“CLOSED” Mode means closed... if you press the menu selection 2 times the motor will close valve to the maximum flow, 1 time is part closed.

Standby mode should be used any time the flow control function is not possible. This extends the life of the controller and speed flow recovery times. Since the valve is frozen, it will already be closer to the correct place when control function is resumed. Standby mode also consumes less power.

SETPOINT DETERMINATION

On the main screen to the upper left side, below the flow rate bar, is the current selected SETPOINT. If “DSP” is the selected, then the Touchpad Setpoint is selected.

On the “Setpoint” menu there are 4 choices to provide the Setpoint, or the desired flow rate, that is to be used to maintain a flowrate. DSP choice will display a Touchpad for entering the flow.

Example: using the pad → 0.432 then press ENTER will display on the main screen “DSP432” which means the Setpoint is 432 mL/min and is being commanded from the internal touchpad.

Another choice for Setpoint is Analog. Analog requires the EAA option and requires electrical connections to your source (voltage or current) to the 15 PIN connector. [See page 1 for wiring information]. For Analog choices be sure to use the User Selections for the Analog Module.

Configuration / Modules / Analog Module / Input Settings / Type

(And you should also select the Output as well)

[Configuration / Modules / Analog Module / Output Settings/Type]

Next goto SETPOINT and choose “Analog”. Other choices available & require additional software (USB , RS485)

CALIBRATION / PID PARAMETERS

FILTER SETTING

Also very important is the “# Points” choice on the PID Parameters menu. Values from 1 to 8 (8 usually is good). This number will improve noise considerably if set to value 8 ... the maximum value. 1 will be more noisy in some applications.

TERMINAL COMMUNICATION

For using a Terminal to communicate, here is Putty as our Example:

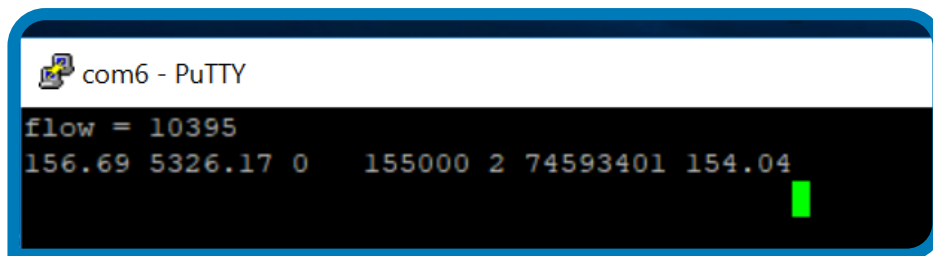
- 1 After downloading PuTTY, select the 64 bit or 32 bit version to match your PC.
- 2 Connect the micro-USB cable from the IRIDIUM flow controller to your PC's USB connector.
- 3 Double click putty.exe to execute it.
- 4 Expand Connection > Serial. Enter the port number inside “Serial line to connect to” text box. The port number is COM6 in below example. The port number will likely be different in your computer. Enter the correct port number when you connect from your computer. The values used are not critical as they are not actually used for the USB that simulates a COM port.

NOTE: After each command is entered, then press the Enter Key also known as *ascii character 13*

FS & GETDATA COMMANDS

Responses from “fs” command.....then Enter

And from “getdata” command..... then Enter



```
com6 - PuTTY
flow = 10395
156.69 5326.17 0 155000 2 74593401 154.04
```

FS COMMAND

The fs command returns a number which is the sensor wheel speed. It is the number above 10395 which means 103.95 Hz, [Hz * 100]. This is the instantaneous speed at that sample time.

Speeds from 0 to 500 Hz are typical values. These numbers are used in the Calibration Table which is used to interpolate between 20 or more calibration points, and to convert Hz to the indicated calibrated flow rate.

GETDATA COMMAND

The getdata command returns 7 different numbers.

- 1 the flow rate in mL/min [as above 156.69 mL/min]
- 2 Total Flow from the Totalizer [as above 5326.17 mL]
- 3 the Setpoint Source [there are 4 of these: 0 is the Touchscreen, 1 is the Analog In, 2 is the USB, 3 is the RS485]
- 4 the Setpoint value in mL/min * 1000 [as above 155000 means 155 mL/min], actually it is in microliters/min
- 5 the Control Mode [there are 5 of these] in this case 2 means Auto
- 6 the timestamp an indicator of relative time for a time stamp
- 7 the averaged flowrate in mL/min, less variations than #1 flowrate, several flowrate data points are averaged together

NOTE: COMMANDS ARE NOT CASE SENSITIVE.

OTHER COMMANDS

TOTALIZER

To reset the totalizer -> **set TotalFlow=0**

SETPOINT SOURCE

To select the USB as a source for a setpoint -> **set SetpointSource=2**

[0 is the Touchscreen pad, 1 is Analog voltage or current]

To set a specific setpoint -> **set setpoint=411000**

This example makes the USB setpoint 411 mL/min.

NOTE: UNITS ARE MICROLITERS IN THIS SETTING

AUTO CONTROL

To set the flow controller in full normal Auto control mode -> **set FVCntl=2**

In this setting the flow rate will be controlled to the setpoint value.

[0 means Close the Valve, 1 means Open the valve, 2 is Flow Control active, 3 is Auto-standby, 4 is Full Standby means valve is frozen in place]

ALARM SECTIONS

There are 4 different Alarm sections and each can activate either Relay A or B. Usually one Alarm is all that will be needed.

DISPENSE FUNCTIONS SUGGESTIONS

Use an External on-off valve – close to the point of dispense. The valve can be switched by a suitable external relay that is activated by the IRIDIUM Relay A. (Be sure to have the relay A active and to select its operation function - for either opening or closing when activated). The internal relay A has limited power handling capacity, so it is best to have it power another larger relay for the on-off valve.

Entrapped air in the IRIDIUM or in any liquid lines will make the dispense incorrect. It may be that the actual Total dispense will be slightly higher or lower than the setting for Totalizer total due to the length of tubing, pressure drops, an valve open-close speeds, or other factors. If so, give the Total command a number higher or lower to increase the accuracy of the dispense.

When an external valve is closing the flow path to the Iridium it is best to consider using the Standby Mode for Iridium which holds the proportional valve position in a more useful location than Auto Mode which will go fully open as flow stops.

A possible sequence to use: **Set ID=51** (the IRIDIUM ID we will communicate with)

--- Assumption --> Already we have configured Relay A .. and our Units are to be milliliters & minutes ... (use the relay commands)

Set FVCNTL=4 ... (after we have a correct flow rate, with External valve Open then we can hold proportional the internal valve in the most reasonable position – and it will not be affected as we Externally start & stop the flow during dispense) **Flowrate will depend upon the Flowrate Setpoint & having External valve open.**

SEQUENCE FOR A DISPENSE

Set alarmNum=1	the Alarm 1 settings we will use, not 2,3, or 4
Set AlarmAction=2	use Relay A)
Set AlarmCondition=5	Totalizer choice – activates when we reach total)
Set AlarmReset=1	when the Total is is not at the dispense value we set)
Set AlarmTotal=356	the relay activates when totalizer reaches this value)
	This should be when the External valve is suddenly closed
Set TotalFlow=0	Resets the Totalizer & a new dispense can begin)
	The External valve will suddenly open
	At point the Totalizer reaches the value we commanded the Dispense will again stop