ETHERNET/IP OPERATING MANUAL

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Contents

Alicat Devices with EtherNet/IP™

This manual is to assist in connecting, configuring, and using an EtherNet/IP™ (EIP) configured Alicat device. Alicat EIP devices are noted by the RJ45 ethernet ports on top of the body and the -EIP code in the product number. These devices function as a communications adapter (device type 12) in an EIP system and are certified by ODVA™.

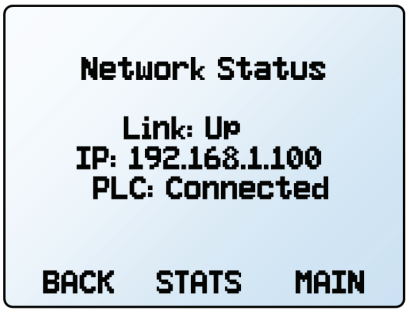
Alicat EIP devices can be integrated into any process using a daisy chain or ring topology and are designed to work with any EtherNet/IP™ capable PLC. Alicat devices also interoperate with other EtherNET/IP™ slaves that are on the same network.

Alicat provides an electronic data sheet (EDS) file for connecting to EIP systems. To download the EDS file, please visit alicat.com/eip.

Communication Status Menu

While not all EtherNet/IP™ devices are equipped with a display, those that are have a communication settings menu that is not detailed in the device manual. To access the screen press **MENU** → **Setup** → **Advanced** → **Comm Status**.

This screen displays network status information used to diagnose communication issues including if the connection link is established, the Alicat device's current IP address, and if it's connected to a PLC.



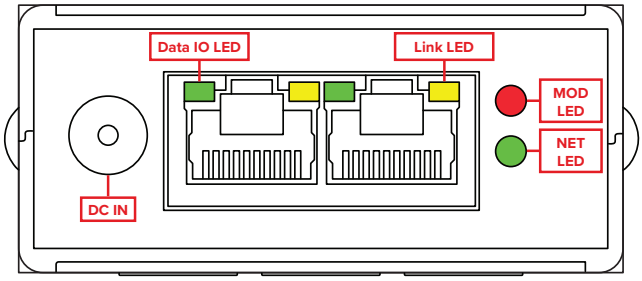
Comm Status Menu

Device Body

Both RJ45 ports can be used to communicate with the device or daisy chain to other devices. Either port is also acceptable for use in a star topology network.

Each port has two LED lights, one yellow and one green. The yellow light is the **link LED**. This light shows when the device has an active connection. The light is stable when the connection is established and only goes out when there is not an active connection to the device. The green light is the **data I/O LED** which blinks as data is either received or transmitted by the device.

LED Status	MOD LED	NET LED
Off	Device not powered	No IP address assigned
Steady Green	Device operational	EIP connection established
Steady Red	Major system fault	Duplicate IP conflict
Flashing Red	Minor system fault	Connection timed out
Flashing Red & Green	Self-test	Self-test



To the right of the RJ45 ports (with the display or brand label and directional arrow facing towards you) are the **MOD LED** and the **NET LED**. The far light, or the light closer to the back of the device, is the **MOD LED**. This is used to indicate the status of the device itself and if there are any faults within it. The near light, or the light closer to the front of the device, is the **NET LED**. The **NET LED** is used to indicate issues with the Ethernet/IP™ connection. Either light can illuminate as red or green. Use the table to determine what their lighting indicates.

Network Configuration

Alicat EIP devices have two 10/100Mbps Ethernet ports with an embedded switch. Either port is available to be used in a star topology configuration. Linear and ring topologies can use one port as the input and the other as the output to daisy chain devices.

IP Address Configuration

By default, Alicat EIP devices obtain their IP address using DHCP. Devices with a display can view the assigned IP address. Navigate to **MENU** → **Setup** → **Advanced** → **Comm Status**. Devices without a display require your network administrator to determine the IP address assigned by the DHCP server. If the device loses power, the IP may change when it's powered back on.

It's possible to change the device to use a static IP either through the device's web server (page 22) or via the TCP/IP CIP object. Before performing any IP address changes, confirm with your network administrator which IP addresses are available.

Assigning a Static IP with the Embedded Webserver

All Alicat EIP devices have an embedded webserver that can be accessed by navigating to its IP using a browser. For more information on the webserver, see page 22.

To assign the Alicat EtherNet/IP device a static IP using the webserver, first navigate to the webserver using its currently assigned IP. Click **Network Config** on the left-hand side of the page to open the IP settings. By default, the **Use DHCP** setting is enabled, and the **IP Address**, **Subnet Mask**, and **Gateway** fields are locked. Clear the **Use DHCP** checkbox to disable DHCP and unlock the fields. Update the IP address information as needed and select **Update**.

When the network information is changed, the connection to the device's webserver is lost. Navigate to the new IP address in the browser to reestablish connection to the webserver.

Static IP by Other Methods

The IP address can be assigned by other software and automation programs, such as the Rockwell Bootp/DHCP server or Molex EIP Tools. Refer to the documentation of your chosen program for further assistance in connecting an Alicat EIP device.

EtherNet/IP™ Communication

Alicat devices are used as communications adapters (device type 12) in the EtherNet/IP protocol. Both CIP explicit messages and cyclic I/O data formats can be used with an Alicat Ethernet/IP device. The EDS for Alicat devices can be downloaded from the CIP file object (Class 0x37, Instance 200) or at alicat.com/eip.

The following lists the objects and attributes that are supported on an Alicat device. All objects support the Get_Attribute_ Single and Set_Attribute_Single services in addition to any other services.

Explicit Messaging I/O

This section lists the objects and attributes that are supported on an Alicat device. All objects support the Get_Attribute_ Single and Set_Attribute_Single services in addition to any other services.

Identity Object Class 1, Instance 1

Attribute	Name	Type	Access	Comment
1	Vendor ID	UINT	Get	1174
2	Device Type	UINT	Get	12
3	Product Code	UINT	Get	2
4	Revision	STRUCT	Get	Major.Minor
5	Status	WORD	Get	
6	Serial Number	UDINT	Get	
7	Product Name	STRING	Get	

Assembly Object Class 4

Attribute	Name	Type	Access	Comment
3	Data	ARRAY	Get/Set	See the following instance descriptions.
4	Number Available	UINT	Get	Size of attribute 3.

Real Format Assemblies

The following assemblies use the real data format. These assemblies may be used in an implicit or explicit connection.

Setpoint Request Real format Assembly 100

Assembly 100 is used for managing the setpoint of Alicat controllers. The setpoint is the flow rate or pressure the controller attempts to maintain when a process is flowing. Meters and gauges ignore Assembly 100 as they do not have valves to control the process.

The setpoint must be sent as a 32-bit IEEE floating point value.

Byte Offset	Type	Description
0	REAL	Requested setpoint

Standard Readings Assembly 107

Assembly 107 presents the device readings in a real data type format. Use the following table to determine the byte offset for the desired reading.

Byte Offset	Type	Description
0	UINT	Gas number
2	UINT	Alarm outputs state
4	UDINT	Device status
8	REAL	Current setpoint
12	REAL	Current valve drive
16	REAL	Current primary pressure reading.
20	REAL	Current secondary pressure reading, if any.
24	REAL	Current barometric pressure reading
28	REAL	Current temperature reading
32	REAL	Current volumetric flow reading
36	REAL	Current mass flow reading
40	REAL	Current totalizer 1 reading
44	REAL	Current totalizer 2 reading
48	REAL	Current humidity reading

Optimized Reading Assembly 101

An Alicat device can measure up to 20 different data statistics, depending on the device configuration. The data statistics are also found on the embedded web server under the Data I/O section (page 22). The following table shows how the readings are structured in assembly 101 using the real data format. See assembly 112 (page 10) for more information on the readings.

Byte Offset	Type	Description
0	UINT	Gas number
2	UDINT	Device status
6	REAL	Reading 1
10	REAL	Reading 2
14	REAL	Reading 3
...	...	...
82	REAL	Reading 20

Integer Format Assemblies

The following assemblies use the integer data format. These assamblies may be use in an implicit or explicit connection.

Setpoint Request Assembly 105

Assembly 105 is used to show the requested setpoint of the controller. This is presented in an integer data format. Meters and gauges ignore this assembly.

Byte Offset	Type	Description
0	DINT	Requested setpoint. Scale integer value by 10^(-assembly 111 offset 22 value) for value in engineering units.

Standard Readings Assembly 108

Assembly 108 presents device readings in an integer format. Use the following table to determine the byte offset of the desired reading and how to scale the value, if applicable.

Byte Offset	Type	Description
0	UINT	Gas number
2	UINT	Alarm outputs state
4	UDINT	Device status
8	DINT	Current setpoint. Scale integer value by 10^(- of offset 22 in assembly 111) for value in engineering units.
12	DINT	Current valve drive. Scale integer value by 10^(- of offset 38 in assembly 111) for value in engineering units.
16	DINT	Current primary pressure reading. Scale integer value by 10^(- of offset 54 in assembly 111) for value in engineering units.
20	DINT	Current secondary pressure reading, if any. This may be from a second pressure sensor or calculated using an available barometer. Scale integer value by 10^(- of offset 70 in assembly 111) for value in engineering units.
24	DINT	Current barometric pressure reading. Scale integer value by 10^(- of offset 86 in assembly 111) for value in engineering units.
28	DINT	Current temperature reading. Scale integer value by 10^(- of offset 102 in assembly 111) for value in engineering units.
32	DINT	Current volumetric flow reading. Scale integer value by 10^(- of offset 118 in assembly 111) for value in engineering units.
36	DINT	Current mass flow reading. Scale integer value by 10^(- of offset 134 in assembly 111) for value in engineering units.
40	DINT	Current totalizer 1 reading. Scale integer value by 10^(- of offset 150 in assembly 111) for value in engineering units.
44	DINT	Current totalizer 2 reading. Scale integer value by 10^(- of offset 166 in assembly 111) for value in engineering units.
48	DINT	Current humidity reading. Scale integer value by 10^(- of offset 182 in assembly 111) for value in engineering units.

Optimized Readings Assembly 106

An Alicat device can measure up to 20 different data statistics, depending on the device configuration. The data statistics are also found on the embedded web server under the Data I/O section (page 22). The following table shows how the readings are structured in assembly 101 using the integer data format. See assembly 112 (page 10) for more information on the readings.

Byte Offset	Type	Description
0	UINT	Gas number
2	UINT	Alarm outputs state
4	UDINT	Device status
8	DINT	Reading 1. Scale integer value by 10^(- of offset 14 value in assembly 112) for value in engineering units.
12	DINT	Reading 2. Scale integer value by 10^(- of offset 30 value in assembly 112) for value in engineering units.
16	DINT	Reading 3. Scale integer value by 10^(- of offset 46 value in assembly 112) for value in engineering units.
...	...	
84	DINT	Reading 20. Scale integer value by 10^(- of offset 316 in assembly 112) for value in engineering units.

Information Assemblies

The information assemblies provide details on items like firmware, a statistic's engineering units, its minimum and maximum values, and the reading type. Both assemblies may only be used explicitly.

Standard Readings Information Assembly 111

Assembly 111 provides information on the readings in 107 and 108. Details on the engineering units of a reading, its source, or its maximum and minimum value can be found in this assembly. Use the following table to find the desired information on readings. Where noted, the appendices (page 27) provide more information on a given value.

Byte Offset	Type	Description
0	UINT	The number indicating which major firmware release the device has installed. Example: The 10 in 10v05.0
2	UINT	The number indicating which minor firmware release the device has installed. Example: The 05 in 10v05.0
4	UINT	The number indicating which custom firmware is installed on the device, if any. Example: The .0 in 10v05.0
6	UINT	Reserved for internal Alicat use. This is always 0.
8	UINT	Setpoint type; one of the statistic values from Appendix A or 0 if the reading is not available.
10	UINT	Setpoint source; one of the values from Appendix C or 0 if the reading is not available.
12	DINT	The minimum value of the setpoint, without overrange. Scale integer value by 10^(- of offset 22) for value in engineering units.
16	DINT	The maximum value of the setpoint, without overrange. Scale integer value by 10^(- of offset 22) for value in engineering units.
20	UINT	Setpoint units; one of the values from Appendix B , or 0 if the reading is not available.
22	UINT	Setpoint decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
24	UINT	Valve drive type; one of the statistic values from Appendix A , or 0 if the reading is not available.
26	UINT	Valve drive source; one of the values from Appendix C , or 0 if the reading is not available.
28	DINT	The minimum value of the valve drive, without overrange. Scale integer value by 10^(- of offset 38) for value in engineering units.
32	DINT	The maximum value of the valve drive, without overrange. Scale integer value by 10^(- of offset 38 value) for value in engineering units.
36	UINT	Valve drive units; one of the values from Appendix B , or 0 if the reading is not available.
38	UINT	Valve drive decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
40	UINT	Pressure type; one of the statistic values from Appendix A , or 0 if the reading is not available.
42	UINT	Pressure source; one of the values from Appendix C , or 0 if the reading is not available.
44	DINT	The minimum value of the pressure, without overrange. Scale integer value by 10^(- of offset 54 value) for value in engineering units.
48	DINT	The maximum value of the pressure, without overrange. Scale integer value by 10^(- of offset 54 value) for value in engineering units.
52	UINT	Pressure units; one of the values from Appendix B , or 0 if the reading is not available.
54	UINT	Pressure decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
56	UINT	Secondary pressure type; one of the statistic values from Appendix A , or 0 if the reading is not available.
58	UINT	Secondary pressure source; one of the values from Appendix C , or 0 if the reading is not available.
60	DINT	The minimum value of the secondary pressure, without overrange. Scale integer value by 10^(- of offset 70 value) for value in engineering units.
64	DINT	The maximum value of the secondary pressure, without overrange. Scale integer value by 10^(- of offset 70) for value in engineering units.
68	UINT	Secondary pressure units; one of the values from Appendix B , or 0 if the reading is not available.
70	UINT	Secondary pressure decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
72	UINT	Barometric pressure type; one of the statistic values from Appendix A , or 0 if the reading is not available.
74	UINT	Barometric pressure source; one of the values from Appendix C , or 0 if the reading is not available.
76	DINT	The minimum value of the barometric pressure, without overrange. Scale integer value by 10^(- of offset 86) for value in engineering units.
80	DINT	The maximum value of the barometric pressure, without overrange. Scale integer value by 10^(- of offset 86) for value in engineering units.
84	UINT	Barometric pressure units; one of the values from Appendix B , or 0 if the reading is not available.
86	UINT	Barometric pressure decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
88	UINT	Temperature type; one of the statistic values from Appendix A , or 0 if the reading is not available.
90	UINT	Temperature source; one of the values from Appendix C , or 0 if the reading is not available.

Byte Offset	Type	Description
92	DINT	The minimum value of the temperature, without overrange. Scale integer value by 10^(- of offset 102) for value in engineering units.
96	DINT	The maximum value of the temperature, without overrange. Scale integer value by 10^(- of offset 102) for value in engineering units.
100	UINT	Temperature units; one of the values from Appendix B , or 0 if the reading is not available.
102	UINT	Temperature decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
104	UINT	Volumetric flow type; one of the statistic values from Appendix A , or 0 if the reading is not available.
106	UINT	Volumetric flow source; one of the values from Appendix C , or 0 if the reading is not available.
108	DINT	The minimum value of the volumetric flow, without overrange. Scale integer value by 10^(- of offset 118) for value in engineering units.
112	DINT	The maximum value of the volumetric flow, without overrange. Scale integer value by 10^(- of offset 118) for value in engineering units.
116	UINT	Volumetric flow units; one of the values from Appendix B , or 0 if the reading is not available.
118	UINT	Volumetric flow decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
120	UINT	Mass flow type; one of the statistic values from Appendix A , or 0 if the reading is not available.
122	UINT	Mass flow source; one of the values from Appendix C , or 0 if the reading is not available.
124	DINT	The minimum value of the mass flow, without overrange. Scale integer value by 10^(- of offset 134) for value in engineering units.
128	DINT	The maximum value of the mass flow, without overrange. Scale integer value by 10^(- of offset 134) for value in engineering units.
132	UINT	Mass flow units; one of the values from Appendix B , or 0 if the reading is not available.
134	UINT	Mass flow decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
136	UINT	Totalizer 1 type; one of the statistic values from Appendix A , or 0 if the reading is not available.
138	UINT	Totalizer 1 source; one of the values from Appendix C , or 0 if the reading is not available.
140	DINT	The minimum value of totalizer 1, without overrange. Scale integer value by 10^(- of offset 150) for value in engineering units.
144	DINT	The maximum value of totalizer 1, without overrange. Scale integer value by 10^(- of offset 150) for value in engineering units.
148	UINT	Totalizer 1 units; one of the values from Appendix B , or 0 if the reading is not available.
150	UINT	Totalizer 1 decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
152	UINT	Totalizer 2 type; one of the statistic values from Appendix A , or 0 if the reading is not available.
154	UINT	Totalizer 2 source; one of the values from Appendix C , or 0 if the reading is not available.
156	DINT	The minimum value of totalizer 2, without overrange. Scale integer value by 10^(- of offset 166) for value in engineering units.
160	DINT	The maximum value of totalizer 2, without overrange. Scale integer value by 10^(- of offset 166) for value in engineering units.
164	UINT	Totalizer 2 units; one of the values from Appendix B , or 0 if the reading is not available.
166	UINT	Totalizer 2 decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
168	UINT	Humidity type; one of the statistic values from Appendix A , or 0 if the reading is not available.
170	UINT	Humidity source; one of the values from Appendix C , or 0 if the reading is not available.
172	DINT	The minimum value of the humidity, without overrange. Scale integer value by 10^(- of offset 182) for value in engineering units.
176	DINT	The maximum value of the humidity, without overrange. Scale integer value by 10^(- of offset 182) for value in engineering units.
180	UINT	Humidity units; one of the values from Appendix B , or 0 if the reading is not available.
182	UINT	Humidity decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.

Optimized Readings Information Assembly 112

Assembly 112 provides information on the readings in assemblies 101 and 106. Details on the engineering units of a reading, its source, or its maximum and minimum value can be found in this assembly. Use the following table to find the desired information on readings. Where noted, the appendices (page 27) provide more information on a given value.

Byte Offset	Type	Description
0	UINT	Reading 1 type; one of the statistic values from Appendix A , or 0 if the reading is not available.
2	UINT	Reading 1 source; one of the values from Appendix C , or 0 if the reading is not available.
4	DINT	The minimum value of the setpoint, without overrange. Scale integer value by 10^(- of offset 14) for value in engineering units.
8	DINT	The maximum value of the setpoint, without overrange. Scale integer value by 10^(- of offset 14) for value in engineering units.
12	UINT	Reading 1 units; one of the values from Appendix B , or 0 if the reading is not available.
14	UINT	Reading 1 decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
16	UINT	Reading 2 type; one of the statistic values from Appendix A , or 0 if the reading is not available.
18	UINT	Reading 2 source; one of the values from Appendix C , or 0 if the reading is not available.
20	DINT	The minimum value of reading 2, without overrange. Scale integer value by 10^(- of offset 30) for value in engineering units.
24	DINT	The maximum value of reading 2, without overrange. Scale integer value by 10^(- of offset 30) for value in engineering units.
28	UINT	Reading 2 units; one of the values from Appendix B , or 0 if the reading is not available.
30	UINT	Reading 2 decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
32	UINT	Reading 3 type; one of the statistic values from Appendix A , or 0 if the reading is not available.
34	UINT	Reading 3 source; one of the values from Appendix C , or 0 if the reading is not available.
36	DINT	The minimum value of reading 3, without overrange. Scale integer value by 10^(- of offset 46) for value in engineering units.
40	DINT	The maximum value of reading 3, without overrange. Scale integer value by 10^(- of offset 46) for value in engineering units.
44	UINT	Reading 3 units; one of the values from Appendix B , or 0 if the reading is not available.
46	UINT	Reading 3 decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.
...	...	
304	UINT	Reading 20 type; one of the statistic values from Appendix A , or 0 if the reading is not available.
306	UINT	Reading 20 source; one of the values from Appendix C , or 0 if the reading is not available.
308	DINT	The minimum value of reading 20, without overrange. Scale integer value by 10^(- of offset 86) for value in engineering units.
312	DINT	The maximum value of reading 20, without overrange. Scale integer value by 10^(- of offset 86) for value in engineering units.
316	UINT	Reading 20 units; one of the values from Appendix B , or 0 if the reading is not available.
318	UINT	Reading 20 decimal places; the number of digits after the implicit decimal place in the current value, minimum value, and maximum value.

Command Assemblies

Commands are sent to a device by writing the command ID and its argument to assembly 109. Once written to the device, the status and results of the command can be found in assembly 110.

Assemblies 102 and 103 are limited command assemblies to allow for integration with systems that used older Alicat EIP commands.

Command Request Assembly 109

To send a command, write the command ID to byte offset 0 in 109. The ID designates what command the device is going to run. Then, write the argument for the command into byte offset 4 of 109. The argument selects one of the possible options that a command can run.

When writing multiple commands, be sure to run the clear command between each one. This clears out all previous command information and ensures the next command is written to the device as intended.

For a list of possible commands and their arguments, see the Commands section (page 12).

Byte Offset	Type	Description
0	UDINT	Command ID
4	DINT	Command Argument

Command Result Assembly 110

After sending a command to assembly 109, use assembly 110 to read the status of the command. The assembly provides the command ID, argument, status of the command, and the return value of the command.

See the command results section (page 12) for more information on command status information.

Byte offset	Type	Description
0	UDINT	ID of last command written to 109.
4	DINT	Argument of last command written to 109.
8	UDINT	Status of last command written.
12	DINT	Return value of last command written to 109.

Limited Command Request Assembly 102

Send commands to the device using assembly 102. To send a command, write the command ID and argument to assembly 102. The results are read in assembly 103.

Commands are only executed when the values of instance 102 change. That means repeating identical commands without changing the command ID or argument does not have an effect. If sending identical commands multiple times is necessary, separate the commands by using a command ID of 0. If using any Alicat instruction sets, this has been automatically written into the set.

Assembly 102 may use any command from the Commands section (page 12) with two requirements. The command ID must be equal to or less than 65535 and the firmware of the device must be equal to or greater than the firmware the command was introduced in.

Parameter	Type	Description
Command ID	UINT	See commands section (page 12).
Command argument	UINT	See desired command description for argument.

Limited Command Results Assembly 103

After a command is written to assembly 102, the result is readable in assembly 103. Only the result of the most recent command is readable in the assembly. The structure of the command results is shown in the following table.

See the command section (page 12) for more information on command status information.

Parameter	Type	Description
Command ID	UINT	ID of the last used command.
Command status	UINT	Status of the last used command.

COMPOSER™ Configuration Assembly 104

Assembly 104 is to be used in conjunction with the create gas mix command (ID 2). The command assigns the mixture to a gas index number between 236 and 255. Use the desired index number as the argument for the command to assign it to that number. If there is already a mixture on that number, the command overwrites the previously defined mixture.

To have the command assign the new gas mixture to the first available index, use 0 as the command argument. The command then writes the mixture to the first available gas index number starting at 255 and moving down until all available index numbers are used. If there are no available index numbers, the command fails.

Before running the create gas mix command, a mixture must be configured in assembly 104. The assembly accepts a 20-byte input that is structured with each gas followed by what percentage of the mixture it constitutes. Use the following table to determine the structure of the assembly before running the command.

A mixture can be composed of up to 5 different gases. If a gas index number is not a valid gas for the device, the command fails. Refer to the device manual, or the installed gas list via the device display to confirm the gases installed on the device.

The percentages must be written as 100ths of the desired percentages. The total of all the gas percentages must be 100% or 10,000. If the total percentage is not 100, then the command fails.

Byte Offset	Type	Description
0	UINT	Mixture gas number 1
2	UINT	Mixture gas 1 percentage
4	UINT	Mixture gas number 2
6	UINT	Mixture gas 2 percentage
8	UINT	Mixture gas number 3
10	UINT	Mixture gas 3 percentage
12	UINT	Mixture gas number 4
14	UINT	Mixture gas 4 percentage
16	UINT	Mixture gas number 5
18	UINT	Mixture gas 5 percentage

Commands

Commands require a command ID and argument written to the Command Request, assembly 109 (page 10) or Limited Command Request, assembly 102 (page 11). To send a command, write the command ID and the argument to their respective assembly locations.

Byte Offset	Type	Description
0	Unsigned32	The ID of the desired command
4	Integer32	The argument of the desired command

After a device runs a command, it sets a command status and reports that status with a numerical value. Refer to the following table to determine the associated status with the given numerical value.

Status Value	Status Name	Description
0	SUCCESS	The last command completed successfully.
1	IN_PROGRESS	A command is currently executing.
2	INVALID_ID	The ID of the last command is invalid.
3	INVALID_ ARGUMENT	The argument of the last command is invalid.
4	UNSUPPORTED	The last command is not supported by the device.
5	INVALID_MIX_IDX	The requested gas mix number is invalid.
6	INVALID_ MIX_GAS	A gas used in the mix does not exist on the device.
7	INVALID_ MIX_PCT	The gas mix fractions do not sum to 100%.

Some commands provide a return value. The command descriptions in this manual outline the meaning of any return value the command may provide. If a command does not define a return value, the command places a 0 in the return value field.

It is not possible to repeat a command multiple times in a row. If repetition is necessary, run a **no operation** command between the repeated commands. Running a **no operation** command before or after all commands can prevent any issues with an unintended command repeating.

The following commands outline what firmware version they were first introduced in, their command ID, the command's function, their possible arguments, and the results of a successful command.

Command Function

The command function is used to ensure commands run as intended.

No Operation

Firmware: 1v00

Command ID: 0

This command does nothing. It is required to separate identical command IDs and arguments. This command may be used before every command or at any time.

Argument: This command ignores any argument.

Data Readings

The data readings commands provide information on the readings a device can have. This includes the reading types, source, minimum and maximum values, engineering units, and the number of decimal places.

The return values for these commands often return a numerical value that is associated with a specific reading type, reading source, or engineering unit. Where noted, refer to the appropriate appendix (page 27) to determine the association of the given return value.

Query Reading Type

Firmware: 10v07

Command ID: 32

Query reading type requests the statistic of the reading noted in the argument.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if the device has a reading associated with the request argument. The return value is the value of the statistic of the requested reading. Refer to **Appendix A** (page 27) for the value's associated statistic.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Query Reading Source

Firmware: 10v07

Command ID: 27

Query reading source requests the source of the reading noted in the argument.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if the device has a reading associated with the requested argument. The return value is the value for the source for the requested reading. Refer to **Appendix C** (page 31) for the value's associated source.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Query Reading Minimum (Integer)

Firmware: 10v07

Command ID: 65538

Query reading minimum (integer) requests the minimum value the reading noted in the argument can have. This value does not include overrange.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if the device has a reading associated with the requested argument. The return value is the minimum value of the reading as an integer. Scale this integer by 10^(reading decimal places) to get the minimum in the reading's engineering units.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Query Reading Minimum (Float)

Firmware: 10v07

Command ID: 65536

Query reading minimum (float) requests the minimum value the reading noted in the argument can have. This value does not include overrange.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if the device has a reading associated with the requested argument. The return value is the minimum value of the reading as an IEEE-754 single precision floating point value. This value is in the reading's engineering units.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Query Reading Maximum (Integer)

Firmware: 10v07

Command ID: 65539

Query reading maximum (integer) requests the maximum value the reading noted in the argument can have. This value does not include overrange.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if the device has a reading associated with the requested argument. The return value is the maximum value of the reading as an integer. Scale this integer by 10^(reading decimal places) to get the maximum in the reading's engineering units.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Query Reading Maximum (Float)

Firmware: 10v07

Command ID: 65537

Query reading maximum (float) requests the maximum value the reading noted in the argument can have. This value does not include overrange.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if there is a reading associated with the requested argument. The return value is the maximum value of the reading as an IEEE-754 single precision floating point value. This value is in the reading's engineering units.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Query Reading Engineering Units

Firmware: 10v07

Command ID: 29

Query reading engineering units requests the current engineering units of the reading noted in the argument.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if the device has a reading associated with the requested argument. The return value is the value for the engineering units of the requested reading. Refer to **Appendix B** (page 29) for the value's associated engineering units.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Set Reading Engineering Units

Firmware: 10v07

Command ID: 65300 + offset

Set reading engineering units changes the engineering units of the desired reading. When writing the command ID, add the offset of the reading to the command ID (65300). For example, to change the engineering unit of the pressure reading, use 65302 as the command ID.

Not all readings are independent of each other. Changing the engineering units of the pressure reading also changes the secondary pressure and barometric pressure.

Offset	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Argument: Use the value of the associated desired engineering units found in **Appendix B** (page 29).

Command response: A SUCCESS status is set if the reading's engineering units are changed. The return value is the value of the requested engineering units.

An UNSUPPORTED status is set if the offset in the command ID is not associated with the device.

An INVALID_ARGUMENT status is set if engineering units are not valid for the reading.

Query Reading Decimal Places

Firmware: 10v07

Command ID: 30

Query reading decimal places sends a request to the device for the number of digits after the implicit decimal place in the requested reading's current, minimum, and maximum values.

Argument: Use the value for the desired reading from the following table.

Value	Reading
0	Setpoint
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass Flow
8	Totalizer 1
9	Totalizer 2
10	Humidity

Command response: A SUCCESS status is set if the device has a reading associated with the requested argument. The return value is the number of decimal places available for the reading.

An INVALID_ARGUMENT status is set if the device has no reading associated with the requested argument.

Control

▶ Controllers only

The control commands are commands for Alicat controllers only. These commands manage the setpoint, valve, and totalizer batches.

Set Power-up Setpoint

Firmware: 7v05

Command ID: 12

Set power-up setpoint stores the current setpoint to be immediately used the next time the controller is powered.

Argument: this command ignores the argument value.

Command Response: A SUCCESS status is set, and the device saves the current setpoint as the power-up setpoint.

Setpoint Maximum Ramp (Saved)

Firmware: 10v07

Command ID: 65546

Setpoint maximum ramp (saved) sets the maximum ramp rate of the setpoint and saves it across power cycles. This command should not be used more often than every few minutes.

Argument: To query the current maximum ramp rate, use a negative value.

To disable the maximum ramp rate, use a value of 0.

To set a maximum ramp rate, determine the desired rate of full-scale percentage change per millisecond and then multiply that value by 10,000,000. For example, if a controller were to ramp to a setpoint by 1% of full scale every second, the device would ramp 0.001% every millisecond. Multiply that 0.001% by 10,000,000 to obtain a value of 10,000. Refer to the following table for further example values.

Maximum Ramp Rate	Value
100% of full scale every millisecond	1000000000
1% of full scale every millisecond	10000000
100% of full scale every second	1000000
100% of full scale every minute	16667
1% of full scale every second	10000
100% of full scale every hour	278
1% of full scale every minute	167
10% of full scale every hour	28

Command Response: A SUCCESS status is set after the command is completed. The return value is the current maximum ramp rate. Multiply the value by 0.0000001 to obtain the ramp rate in percent of full scale per millisecond.

Setpoint Maximum Ramp (Temporary)

Firmware: 10v07

Command ID: 65547

Setpoint maximum ramp (temporary) sets the maximum ramp rate of the setpoint. This command does not save the maximum ramp rate and it is lost when the device loses power.

Argument: To query the current ramp rate, use a negative value.

To disable the ramp rate, use a value of 0.

To set a maximum ramp rate, determine the desired rate of full-scale percentage change per millisecond and then multiply that value by 10,000,000. For example, if a controller were to ramp to a setpoint by 1% of full scale every second, the device would ramp 0.001% every millisecond. Multiply that 0.001% by 10,000,000 to obtain a value of 10,000. Refer to the following table for further example values.

Maximum Ramp rate	Value
100% of full scale every millisecond	1000000000
1% of full scale every millisecond	10000000
100% of full scale every second	1000000
100% of full scale every minute	16667
1% of full scale every second	10000
100% of full scale every hour	278
1% of full scale every minute	167
10% of full scale every hour	28

Command Response: A SUCCESS status is set after the command is completed. The return value is the current maximum ramp rate. Multiply the value by 0.0000001 to obtain the ramp rate in percent of full scale per millisecond.

Hold Valve(s)

Firmware: 7v05

Command ID: 6

Hold valve(s) pauses the controller valve(s) and stops any further control of the process. The command can also cancel a current hold.

Argument: Use the value for the desired effect found in the following table.

Value	Description
0	Cancel valve hold and resume normal closed-loop control.
1	Hold all valves closed.
2	Hold valves at their current positions.
3	Exhaust: Close the upstream valve and fully open the downstream valve. Only supported on dual valve controllers.

Command Response: A SUCCESS status is set if the command sets the valve to the desired argument mode.

An UNSUPPORTED status returns if the requested mode is not supported by the device.

An INVALID_ARGUMENT status is set if the argument value is not valid.

Set Active Valve

Firmware: 7v16

Command ID: 15

Set active valve is only available on MCT stream-switching controllers. The command controls which valve actively controlling the process.

Argument: Use the value for the desired valve found in the following table.

Value	Description
0	Upstream valve or only valve
1	Downstream valve or auxiliary valve if dual valve control is enabled.

Command Response: A SUCCESS status is set if the active valve changes.

An INVALID_ARGUMENT status is set if the value used is not valid.

An UNSUPPORTED status is set if the controller is not an MCT controller.

Set Loop Control Variable

Firmware: 7v05

Command ID: 11

Set loop control variable changes the statistic that the controller actively controls. That means a mass flow controller can be changed to control pressure or volumetric flow if needed.

Argument: Use the value for the desired statistic found in the following table.

Value	Description
0	Mass flow
1	Volumetric flow
2	Differential pressure
3	Absolute pressure
4	Gauge pressure
...	Any setpoint value that is found in **Appendix A** (page 27).

Command Response: A SUCCESS status is set if the loop control variable changes.

An INVALID_ARGUMENT is set if the statistic is not available on the device (e.g., trying to control mass flow on a pressure controller).

Set Loop Control Algorithm

Firmware: 7v08

Command ID: 13

Set loop control algorithm selects either PDF or PD^2I algorithm for the controller. Only one algorithm can be active at a time.

Argument: Use the value of the desired algorithm found in the following table.

Value	Description
1	PDF closed-loop control algorithm
2	PD^2I closed-loop control algorithm

Command Response: A SUCCESS status is set if the desired loop control algorithm is selected.

An INVALID_ARGUMENT status is set if the value is not for a valid algorithm.

Read Closed-Loop Gain

Firmware: 7v08

Command ID: 14

Read closed-loop gain returns the current value of the desired loop gain in the loop control algorithm.

Argument: Use the value of the desired closed-loop gain found in the following table.

Value	Description
0	Proportional gain (p gain) for PDF or PD^2I
1	Derivative gain (d gain) for PDF or PD^2I
2	Integral gain (I gain) for PD^2I

Command Response: A SUCCESS status is set if the argument is a valid choice. The return value is the gain value of the requested closed-loop gain. The value can be between 0 – 65535.

An INVALID_ARGUMENT is set if the gain requested is not a valid choice for the loop control algorithm.

Set Proportional Closed-Loop Control Gain

Firmware: 7v05

Command ID: 8

Set proportional close loop control gain command changes the proportional gain value (P gain) to the desired value used in the argument.

Argument: Use a value between 0 – 65535.

Command Response: A SUCCESS status is set when the command completes, and the gain value is set.

Set Derivative Closed-Loop Control Gain

Firmware: 7v05

Command ID: 9

Set derivative close loop control gain changes the derivative gain value (D gain) to the desired value used in the argument.

Argument: Use a value between 0 – 65535.

Command Response: A SUCCESS status is set when the command completes, and the gain is set.

Set Integral Closed-Loop Control Gain

Firmware: 7v05

Command ID: 10

Set integral close loop control gain changes the integral gain value (I gain) to the desired value used in the argument.

Argument: Use a value between 0 – 65535.

Command Response: A SUCCESS status is set when the command completes, and the gain is set.

Set Inverse Pressure Control

Firmware: 7v18

Command ID: 16

Set inverse pressure control manages how the controller controls pressure. It can be set to control pressure normally or to control the inverse pressure (usually back pressure). This command also sets whether the control mode is saved across power cycles.

Argument: Use the value for the desired setting found in the following table.

Value	Description
0	Enable normal pressure control, not saved across power cycles.
1	Enable inverse pressure (usually back pressure) control, not saved across power cycling.
3	Enable normal pressure control, saved across power cycles.
4	Enable inverse pressure (usually back pressure) control, saved across power cycling.

Command Response: A SUCCESS status is set if the pressure mode has changed.

An INVALID_ARGUMENT status is set if the argument used is not available on the device or does not have an associated pressure control mode.

Query Totalizer Batch (Integer)

Firmware: 10v07

Command ID: 65543

Query totalizer batch (integer) requests the total size of the batch from one of the two totalizers.

Argument: Use a value of 1 to query totalizer 1. Use a value of 2 to query totalizer 2.

Command Response: A SUCCESS status is set if the requested totalizer is enabled. The return value is the total size of the batch of the requested totalizer. To obtain the volume in the requested totalizer's engineering units, multiply the value by 10^(negative totalizer decimal places). The device returns a 0 if batching is disabled.

An INVALID_ARGUMENT status is set if the requested totalizer is not enabled.

Query Totalizer Batch (Float)

Firmware: 10v07

Command ID: 65540

Query totalizer batch (float) requests the total size of the batch from one of the two totalizers.

Argument: Use a value of 1 to query totalizer 1. Use a value of 2 to query totalizer 2.

Command Response: A SUCCESS status is set if the requested totalizer is enabled on the device. The return value is the total size of the batch in the requested totalizer in an IEEE-754 single precision floating point value. This value uses the engineering units of the totalizer. The device returns a 0 if batching is disabled.

An INVALID_ARGUMENT status is set if the requested totalizer is not enabled.

Set Totalizer Batch 1 (Integer)

Firmware: 10v07

Command ID: 65544

Set totalizer batch 1 (integer) manages the batch size of totalizer 1.

Argument: Use the desired batch size multiplied by 10^(totalizer decimal places).

To disable batching, use a value of 0.

Command response: A SUCCESS status is set if totalizer 1 is enabled and the size of the batch is valid. The return value is the batch size.

An UNSUPPORTED status is set if totalizer 1 is not enabled.

An INVALID_ARGUMENT status is set if the volume of the batch is larger than totalizer 1 can hold.

Set Totalizer Batch 1 (Float)

Firmware: 10v07

Command ID: 65541

Set totalizer batch 1 (float) manages the batch size of totalizer 1.

Argument: Use the desired batch size formatted as an IEEE-754 single precision floating point value in the engineering units of totalizer 1.

To disable batching, use a value of 0.

Command response: A SUCCESS status is set if totalizer 1 is enabled and the batch size is valid. The return value is the requested batch volume.

An UNSUPPORTED status is set if totalizer 1 is not enabled.

An INVALID_ARGUMENT status is set if the volume of the batch is larger than totalizer 1 can hold.

Set Totalizer Batch 2 (Integer)

Firmware: 10v07

Command ID: 65545

Set totalizer batch 2 (integer) manages the batch size of totalizer 2.

Argument: Use the desired batch size multiplied by 10^(totalizer decimal places.

To disable batching, use a value of 0.

Command response: A SUCCESS status is set if totalizer 2 is enabled and the size of the batch is valid. The return value is the batch size.

An UNSUPPORTED status is set if totalizer 2 is not enabled.

An INVALID_ARGUMENT status is set if the volume of the batch is larger than totalizer 2 can hold.

Set Totalizer Batch 2 (Float)

Firmware: 10v07

Command ID: 65542

Set totalizer batch 2 (float) manages the batch size of totalizer 2.

Argument: Use the desired batch size formatted as an IEEE-754 single precision floating point value in the engineering units of totalizer 2.

To disable batching, use a value of 0.

Command response: A SUCCESS status is set if totalizer 1 is enabled and the batch size is valid. The return value is the requested batch volume.

An UNSUPPORTED status is set if totalizer 2 is not enabled.

An INVALID_ARGUMENT status is set if the volume of the batch is larger than totalizer 2 can hold.

Administrative

Administrative commands are used to perform actions such as taring the device sensors, creating gas mixes, controlling the display, and restoring factory settings.

Perform Tare

Firmware: 7v05

Command ID: 4

Perform tare instructs the device to use the current reading as the zero reading.

When performing gauge pressure tares, the sensor must be open to the atmosphere.

Differential pressure tares require a common pressure to measure from.

Absolute pressure tares require an equipped barometer.

Flow tares must be performed when there is no current flow through the process. Flow tares are also best when at the process pressure, or as close to it as possible.

Argument: Use the value of the desired tare found in the following table.

Value	Description
0	Tare gauge or differential pressure
1	Tare absolute pressure
2	Tare mass and/or volumetric flow

Command response: A SUCCESS status is set if the requested tare is performed.

An UNSUPPORTED status is set if the requested tare does not apply to the device (e.g., a mass flow tare on a pressure device).

Perform Pressure Sensor Tare

Firmware: 10v07

Command ID: 31

Perform pressure sensor tare instructs the device to use the current gauge or differential pressure reading as the zero reading. An absolute pressure tare uses the barometer's zero reading as the zero reading.

When performing gauge pressure tares the sensor must be open to the atmosphere.

Differential pressure tares require a common pressure to measure from.

Absolute pressure tares require an equipped barometer.

Argument: Use the desired time in milliseconds for the tare to take. This can be a value of 0 – 32767. If a value of 0 is used, a default of 256 milliseconds is used.

Command response: A SUCCESS status is set if the tare is performed.

An UNSUPPORTED status is set if the pressure sensor cannot be tared. This can be due to trying to tare absolute pressure without a barometer.

An INVALID_ARGUMENT status is set if the argument value is less than 0 or greater than 32767.

Perform Secondary Pressure Sensor Tare

Firmware: 10v07

Command ID: 32

Perform secondary pressure sensor tare instructs the device to use the current pressure reading on the secondary pressure sensor as the zero reading. An absolute pressure tare uses the barometer's zero reading as the zero reading. Not all devices have a secondary pressure sensor.

When performing gauge pressure tares the sensor must be open to the atmosphere.

Differential pressure tares require a common pressure to measure from.

Absolute pressure tares require an equipped barometer.

Argument: Use the desired time in milliseconds for the tare to take. This can be a value of 0 – 32767. If a value of 0 is used, a default of 256 milliseconds is used.

Command response: A SUCCESS status is set if the tare is performed.

An UNSUPPORTED status is set if the pressure sensor cannot be tared. This is usually due to attempting to tare absolute pressure without a barometer or not having a secondary pressure sensor.

An INVALID_ARGUMENT status is set if the argument value is less than 0 or greater than 32767.

Perform Flow Tare

▶ Flow devices

Firmware: 10v07

Command ID: 33

Perform flow tare instructs the device to use the current flow reading as the zero reading. This command is used for both volumetric and mass flow.

Argument: Use the desired time in milliseconds for the tare to take. This can be a value of 0 – 32767. If a value of 0 is used, a default of 256 milliseconds is used.

Command response: A SUCCESS status is set if the tare is performed.

An UNSUPPORTED status is set if the pressure sensor cannot be tared. This is usually due to the device not reading volumetric or mass flow.

An INVALID_ARGUMENT status is set if the argument value is less than 0 or greater than 32767.

Reset Totalizer

▶ Flow devices

Firmware: 7v05

Command ID: 5

Reset totalizer instructs the device to clear the current totalizer count.

Argument: No argument is used for this command

Command response: A SUCCESS status is set if the reset is complete.

Set Gas

▶ Mass flow devices

Firmware: 7v05

Command ID: 1

Set gas manages what gas a mass flow device is calibrated to read. The gas must be set to accurately read the mass flow of the process gas.

Argument: Use the index number of the desired gas to measure. The gas index can be found on page 32.

Command response: A SUCCESS status is set if the gas has changed.

An INVALID_ARGUMENT status is set if the requested gas number does not exist.

Create/Update Gas Mix

▶ Mass flow devices

Firmware: 7v05

Command ID: 2

Create/update gas mix writes a new gas mix to the gas index on the device. Before running this command, the custom gas and its properties must be written to the device first. See page 11 for more information on how to write the gas mixture to the device.

Argument: Use 0 or 236-255. This is the gas index number of the new mixture. A value of 0 instructs the device to write to the first available gas index number starting with 255 and moving down. If no gas index numbers are available, then the command will fail.

To update or overwrite a previous custom gas mix, using its gas index number here will overwrite the old mixture.

Command response: A SUCCESS status is set if the gas has changed. The return value is the index number of the gas mix created or updated.

An INVALID_MIX_IDX status is set if the gas index number in the argument is outside of the 236-255 range.

An INVALID_MIX_GAS status is set if one or more gases in the mix do not exist on the device.

An INVALID_MIX_PCT status is set if the percentages of the gases that make up the mixture do not sum 100%.

Delete Gas Mix

▶ Mass flow devices

Firmware: 7v05

Command ID: 3

Delete gas mix removes the specified custom gas mix from the device.

Argument: Use the index number of the desired gas to delete.

Command response: A SUCCESS status is set if the gas mix was deleted.

An INVALID_MIX_IDX status is set if the requested gas mix does not exist.

Set Relative Humidity Percentage

▶ Mass flow devices equipped with humidity sensor

Firmware: 10v07

Command ID: 24

Set relative humidity percentage manages the relative humidity level used for gas corrections.

Argument: Use a value between 0 and 10000. 1 count in the value is equal to 0.01% humidity. For example, use 100 for 1% or 10000 for 100%.

Command response: A SUCCESS status is set if the relative humidity percentage is changed.

An UNSUPPORTED status is set if the relative humidity cannot be set on the device.

An INVALID_ARGUMENT status is set if the argument value is outside of 0 – 10000.

Set Relative Humidity Reference Temperature

▶ Mass flow devices equipped with humidity sensor

Firmware: 10v07

Command ID: 25

Set relative humidity reference temperature manages the relative humidity reference temperature used for gas corrections. This temperature is Celsius.

Argument: Use a value between −3000 and 10000. This value should match the relative humidity percentage.

The range starts at −30°C and reaches 100°C. 1 count in the value is equal to 0.01°C. For example, a value of −3000 is −30°C and a value of 10000 is 100°C.

Command response: A SUCCESS status is set if the relative humidity reference temperature is changed.

An UNSUPPORTED status is set if the relative humidity cannot be set on the device.

An INVALID_ARGUMENT status is set if the argument value is outside of −3000 – 10000.

Lock/Unlock Display

Firmware: 7v05

Command ID: 7

Lock/unlock display instructs the device to either lock or unlock the display on the front of the device. When locked, the device still responds to button presses, but settings cannot be changed using the display.

Argument: Use a value of 0 to unlock the display. Any other value locks the display.

Command response: A SUCCESS status is set if the display is locked or unlocked as requested.

Flash Display

Firmware: 8v28

Command ID: 20

Flash display instructs the device to flash its backlight indefinitely or for a set amount of time.

Argument: Use a number between 1 and 65534 to instruct the device to flash the backlight for that number of seconds. A value of 0 stops the backlight from flashing. A value of 65535 instructs the device to flash the backlight indefinitely.

Command response: A SUCCESS status is set if the backlight is flashing or stopped as requested.

An UNSUPPORTED status is set if no display is connected to the device.

Restore Factory Settings

Firmware: 10v07

Command ID: 26

Restore factory settings reverts all the device settings and configurations to their values when the device was last at Alicat.

> ***!*** *This command should only be used when trying to troubleshoot issues with Alicat support (page 2). All third-party calibrations are removed by performing this command.*

The device needs to be power cycled after performing the restore.

Argument: Use a value of 49374 to confirm that a factory restore is the desired result of the command.

Command response: A SUCCESS status is set if the factory restore completes. This may only be available to read briefly before the restore removes the status.

An UNSUPPORTED status is set if there is an error during the restore process.

An INVALID_ARGUMENT status is set if the argument value is not 49374.

Read Configuration Checksum

Firmware: 8v24

Command ID: 17

Read configuration checksum computes and returns a checksum of the device's calibration and configuration. The checksum is computed at the time of the command initiation and may take 300 milliseconds to complete. A timeout of over 500 milliseconds is recommended.

Any setting that is retained across power cycles is included. Values that may or may not be retained are also included.

Because calibration information is included, two devices with identical configurations may have different checksums. If a device is recalibrated, the checksum may change as well. Changing the device firmware may or may not change the checksum.

Any parameter that changes during routine operation (e.g., setpoint) should be set to a known configuration before reading the checksum.

Argument: Must always be 0.

Command response: A SUCCESS status is set when the checksum is complete, and the argument value is 0. The return value is the checksum of the entire device configuration. This is a value of 0 – 65535.

An INVALID_ARGUMENT status is set when the argument value is not 0.

Embedded Webserver

All Alicat EIP devices have an embedded webserver that provides device information and setting configuration. This can be accessed by navigating to the IP address of the device using your computer's web browser.

Home

The first page of the webserver is the home page. This page is informational and provides information about the device and the status of its network connection.

Alicat webserver home page

Device Information

The device information section has information about the device's communication protocol, firmware, and serial numbers.

- **Protocol:** the communication protocol the device is configured for. This should display as EtherNet/IP. If it does not, please contact Alicat support for assistance (page 2).
- **Device FW Version:** the installed firmware version of the device. This determines how the device operates, the display menu, and the commands available on the device. See alicat.com/firmware for more information on the Alicat firmware versions.
- **Adapter FW Version:** the installed firmware version of the Ethernet adapter. This is used for troubleshooting purposes.
- **Device Serial Num:** the serial number of the device. This number never changes and is the same number as the one on the label found on the back of the device.

Network Status

The network status outlines the various network information the device currently has including MAC address, mode, and IP. These settings can be updated in **Network Config** (page 5).

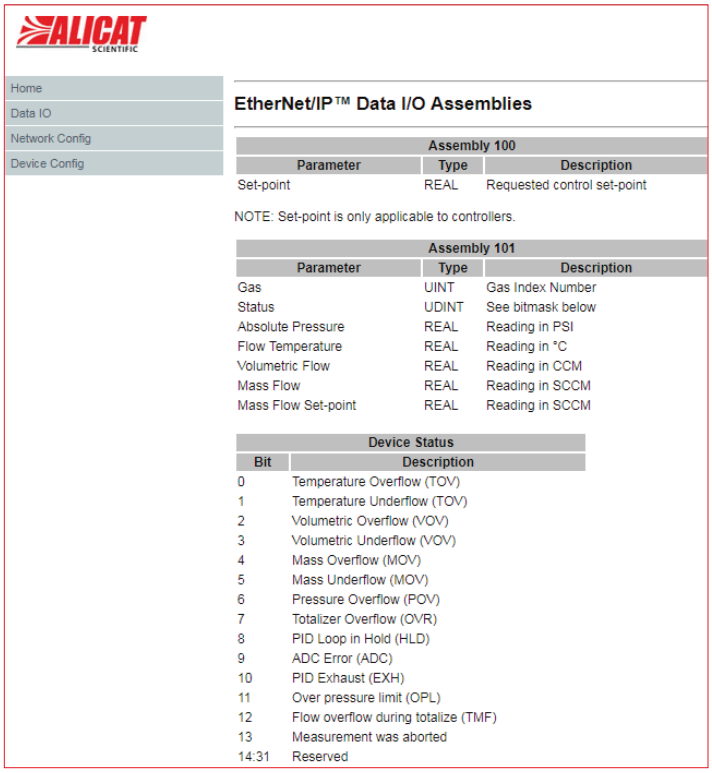
- **MAC Address:** the physical address of the device. This is also printed on a label on the device.
- **Address Mode:** this indicates how the device obtains its IP address. The two possible modes are DHCP and Static.
- **IP Address:** the IP address of the device. This only changes if the **Address Mode** is set to DHCP.
- **Subnet Mask:** the subnet mask of the network the device is connected to. This is determined by the network.
- **Gateway:** the gateway address the device is connected to. This is determined by the network.

Data I/O

The Data I/O page lists the structure of control assemblies and provides information on the device status codes. This page reflects how the device is configured and changes from device to device.

When configuring a PLC or other program to read the device parameters, use the Data I/O page to determine the size and structure of assembly 101. Parameters type of either REAL or UDINT are 4 bytes. Parameter type UINT are 2 bytes. To obtain the size of all the assembly 101 parameters, sum all the byte sizes together. For more information on assemblies, see the **EtherNet/IP™ Communication** section (page 6).

The device status table is a referential table that provides the numerical bit for possible device errors or statuses that can be present on the device. The letters in the parenthesis may appear on the device display (if one is present) to indicate an issue is present. Refer to the list below to determine what is causing the status message to appear.

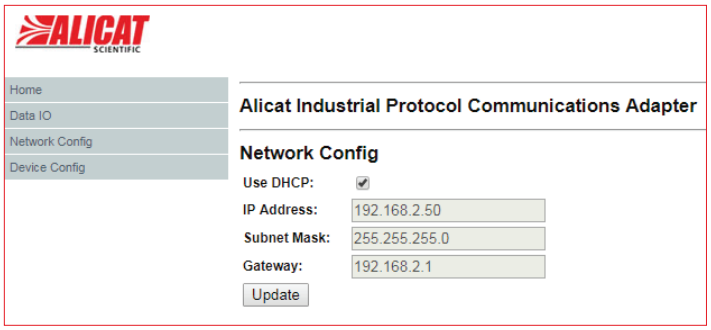


EtherNet/IP™ data I/O page

Network Config

This page provides information on the current IP configuration of the device. When **Use DHCP** has a check mark the network fields are locked. To unlock them, clear the check mark.

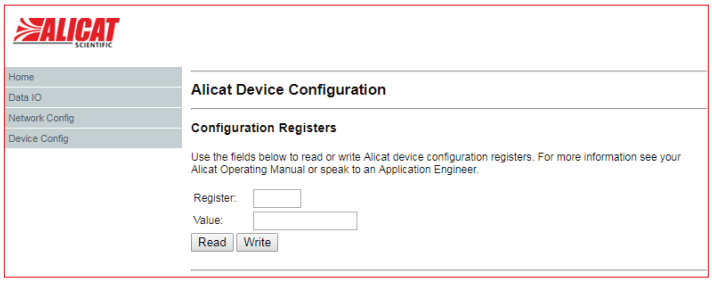
See **Assigning a Static IP with the Embedded Webserver** for more information on assigning a static IP address (page 5).



Network configuration page

Device Config

The device config is a page that is primarily used for troubleshooting the device. The page can read and write device registers that control configuration settings of the device. Do not attempt to write to registers without prior knowledge of how that register works. Writing over registers values may invalidate the device's calibration, disable communication, or permanently damage the device.



Device configuration page

Rockwell PLC Setup

Alicat provides an Electronic Data Sheet (EDS) and Logix XML files with Add-On Instructions (AOIs) to use when connecting to the Rockwell Logix designer. These files are available at alicat.com/eip.

Determining Assembly 101 Input Size

The size and configuration of assembly 101 varies depending on the Alicat device. To connect to the device, the input size of the connection parameters must be defined. If the size is not properly calculated, the PLC faults with an "invalid input size" message.

The size of assembly 101 can be determined by using RSNetWorx. Use the 0x0E: Get Single Attribute service code with an object address of class 4, instance 101, attribute 4 to obtain the assembly size in a hexadecimal format. Note that the instance value needs to be in hexadecimal format, meaning instance 101 would be 65.

It is also possible to determine the size of assembly 101 by using the embedded web server. Refer to the **Data I/O** page of the web server section (page 23).

Create an Alicat Module

There are two options to create an Alicat device module in Logix. The first is to import the Alicat EDS file and create an Alicat EtherNet/IP adapter. The second is to create the device as a Generic Ethernet Module.

EDS

To create the Alicat IO module, the EDS file (found at alicat.com/eip) is required. Once downloaded, it can then be imported in RSLogix by using the **EDS Hardware Installation Tool** in the RSLogix **Tools** menu.

1. Follow the prompts to register a single EDS device.
2. When prompted, browse to the location of the downloaded Alicat EDS file and continue through the Installation Tool. The EDS file needs to be registered as a single file.
3. After the import is complete, right-click on the Ethernet network of the I/O configuration tree and select **New Module**.
4. Select the Alicat EtherNet/IP adapter and press create.
5. Name the module and provide the static IP address assigned to the device.
6. To change the input size, select the **Change** button in the **Module Definition** part of the window. This is optional and can be skipped. Select OK when done.
7. Select OK and repeat the above steps for any other devices that need to be connected.

Generic Ethernet Module

If using an EDS does not meet the needs of your process, it is possible to set up an Alicat device as a Generic Ethernet Module.

1. From the I/O configuration tree, right-click the Ethernet network and select **New Module**.
2. Select the **Generic Ethernet Module** and then select **Create**.
3. Name the module and enter the static IP address assigned to the device.
4. Enter the input size for Assembly 101.
5. Enter the output size for Assembly 100. This is 4 if the device is a controller or 0 if the device is a meter or gauge.
6. For configuration, enter an assembly instance of 1 and a size of 0. Alicat devices do not have a configuration assembly. The configuration assembly is ignored.
7. For the communication format, select SINT to create a controller tag as an array of bytes for Input and output data.
8. Select OK and repeat the previous steps for any other devices to connect.

Formatting I/O Data

When the module is added to RSLogix, controller tags are automatically created with the name given to it during creation followed by an :I for input and a :O for output. For example, if the module is named Alicat Module, the controller tags are named Alicat Module:I for input and Alicat Module:O for output. The default for both is to use arrays of SINT values, but the input and output data are mixed data types.

The Alicat-EIP-UpdateInput.l5x file (found at alicat.com/eip) To format these modules, perform the following:

1. In the main project window, select **File, Import Component**, and then **Add-On Instruction**.
2. Navigate to where Alicat-EIP-UpdateInput.l5x is downloaded and select **Import**.

After the import is complete, an AOI named AlicatUpdateInput, a UDT named ALicatIoData, and an Add-On-Defined data type appear in the controller organization window.

UDT Format

AlicatIoData UDT

Name	Type	Description
Status	DINT	Bitmask of device status flags
Pressure	REAL	Pressure reading
Temperature	REAL	Temperature reading
VolFlow	REAL	Volumetric flow reading
MassFlow	REAL	Mass flow reading
ActualSetpoint	REAL	Setpoint reading
ValveDrivePct	REAL	Valve drive percentage reading
Totalizer	REAL	Totalizer reading
RequestedSetpoint	REAL	Desired setpoint Value
GasIndex	INT	Index number of selected gas
Config	SINT	Validity flags of device

AlicatIoDATA UDT Config Overlay

Name	Type	Description
Config[0] – PRESS	BOOL	Pressure reading is valid.
Config[1] – TEMP	BOOL	Temperature reading is valid.
Config[2] – VFLOW	BOOL	Volumetric flow reading is valid.
Config[3] – MFLOW	BOOL	Mass flow reading is valid.
Config[4] – SP	BOOL	Setpoint reading is valid.
Config[5] – VDRIVE	BOOL	Valve drive percentage reading is valid.
Config[6] – TOTAL	BOOL	Totalizer reading is valid.

AlicatIloData UDT Status Overlay

The status flags have a bit overlay that decodes the individual bit flags.

Name	Type	Description
Status[0] – T_OVER	BOOL	Temperature overflow.
Status[1] – T_UNDER	BOOL	Temperature underflow.
Status[2] – V_OVER	BOOL	Volumetric overflow.
Status[3] – V_UNDER	BOOL	Volumetric underflow.
Status[4] – M_OVER	BOOL	Mass Flow overflow.
Status[5] – M_UNDER	BOOL	Mass Flow underflow.
Status[6] – P_OVER	BOOL	Pressure overflow.
Status[7] – TOT_OVER	BOOL	Totalizer overflow.
Status[8] – HLD	BOOL	PID loop is holding valve positions.
Status[9] – ADC	BOOL	ADC Error.
Status[10] – EXH	BOOL	Controller is exhausting process.
Status[11] – OPL	BOOL	Over pressure limit.
Status[12] – TMF	BOOL	Totalizer missed flow during overflow.

AlicatIoDATA Config Flag

The config flag is stored as a hexadecimal number. If needed, an MOV command accepts binary arguments and converts the type automatically. A binary value can be used by prefacing the number with 2#.

Device	Config	Flags
Pressure Controller	16#11 (2#10001)	PRESS, SP
Mass Flow Meter	16#0F (2#1111)	PRESS, TEMP, VFLOW, MFLOW
Mass Flow Controller	16#1F (2#11111)	PRESS, TEMP, VFLOW, MFLOW, SP

AOI

To use the AOI, create a tag with the AlicatIoData type for each device being used. The AlicatUpdateInput also needs to be tagged to be used by the AOI.

Since the IO data is updated asynchronously in a ControlLogix PLC, create an array of type SINT to buffer the input data before it passes to the AOI. A single buffer can be used for multiple devices provided it is as large as the largest input size. If the buffer is too small, the IO data is truncated.

Changing the Setpoint

To change the setpoint of an Alicat controller, copy a 4-byte floating point (REAL) number to the device output. The AlicatIOData data type includes/read write of REAL type element for storing the desired setpoint. A copy instruction from this element directly into the output tag allows setpoint control by editing this element.

Sending a command

Asynchronous commands can be sent to Alicat devices. Explicit CIP messages can be sent to assemblies 102, 103, and 104. To help with this, an add-on instruction set with logic has been provided. The set sends well-formed commands to instance 102 and automatically reads the result from instance 103.

To use this AOI, import the Elicat-EIP-Command.l5x Add-On Instruction (found at alicat.com/eip). The instruction requires four controller tags to operate:

- Two message tags are needed to define the device path and the explicit message configuration.
- A 4-byte array used as a buffer to store the command and response as it passes to the IO stream.
- A UDT of type AlicatCommand. This prepares the command to be copied to the buffer and is tied to the logic that manages explicit messaging.

A fifth Boolean tag can be used as a switch to start the command.

These tags must be controller tags, or they will not be scoped to communicate with the IO stream.

Configure the MESSAGE tags by clicking on the tag name and selecting configure. Use the following settings to configure the tags for instance 102:

- **Message type:** CIP Generic
- **Service Type:** Set Attribute Single
- **Service Code:** 10
- **Instance:** 102
- **Class:** 4
- **Attribute:** 3
- **Source Element:** AlicatCmdData
- **Source Length:** 4

For instance 103, use the following:

- **Message type:** CIP Generic
- **Service Type:** Set Attribute Single
- **Service Code:** e
- **Instance:** 103
- **Class:** 4
- **Attribute:** 3
- **Destination Element:** AlicatCmdData

On the Communication tab set the path to the desired device for both messages.

Appendices

Appendix A: Statistics

Statistics are readings and measurements that devices provide. Use the following values in commands where indicated to apply the desired statistic to the command.

Specific devices and configurations can restrict what statistics are available. The firmware version in parentheses indicates when the statistic was added. If no version is present, the statistic is available on all devices. Please contact Alicat support (page 2) with any questions about a statistic and how it may work with your device.

Appendix A-1: Flow Statistics

Flow statistic	Value	Notes
Batch mass remaining	**12**	Remaining mass in the totalizer batch
Batch volume remaining	**11**	Remaining volume, referenced to flow conditions, in the totalizer batch.
Mass flow	**5**	Current mass flow
Mass flow, average	**69**	Average mass flow over the time of totalizing.
Mass flow, maximum (8v32)	**175**	Highest mass flow since reset.
Mass flow, minimum (8v32)	**174**	Lowest mass flow since reset.
Mass flow, peak	**101**	Peak mass flow during the time of totalizing.
Mass flow setpoint	**37**	Setpoint for mass flow
Mass flow setpoint error (8v00)	**173**	Mass flow minus the ramp-limited setpoint
Time, totalizing	**10**	Amount of time that the totalizer has been running.
Total mass	**9**	Totalized mass
Total volume	**8**	Totalized volume, referenced to flow conditions.
Volumetric flow	**4**	Volumetric flow, referenced to flow conditions.
Volumetric flow, average	**68**	Average volumetric flow, referenced to flow conditions, over the time of totalizing.
Volumetric flow, maximum (8v32)	**167**	Highest volumetric flow since reset
Volumetric flow, minimum (8v32)	**166**	Lowest volumetric flow since reset.
Volumetric flow, peak	**100**	Peak volumetric flow, referenced to flow conditions, during the time of totalizing.
Volumetric flow setpoint	**36**	The setpoint for volumetric flow referenced to flow conditions.
Volumetric flow setpoint error (8v00)	**165**	Volumetric flow minus the ramp-limited setpoint.

Appendix A-2: Pressure Statistics

Pressure statistic	Value	Notes
Pressure, absolute	**2**	Current absolute pressure
Pressure, absolute maximum (8v32)	**151**	Highest absolute pressure since reset
Pressure, absolute minimum (8v32)	**150**	Lowest absolute pressure since reset
Pressure, absolute setpoint	**34**	Setpoint for absolute pressure
Pressure, absolute setpoint error (8v00)	**149**	Absolute pressure minus the ramp-limited setpoint.
Pressure, barometric	**15**	Barometer reading
Pressure, barometric maximum (8v32)	**255**	Highest barometric pressure since reset
Pressure, barometric minimum (8v32)	**254**	Lowest barometric pressure since reset
Pressure, differential	**7**	Current differential pressure reading
Pressure, differential maximum (8v32)	**191**	Highest differential pressure since reset
Pressure, differential minimum (8v32)	**190**	Lowest differential pressure since reset
Pressure, differential setpoint	**39**	Setpoint for differential pressure
Pressure, differential setpoint error (8v00)	**189**	Differential pressure minus the ramp-limited setpoint
Pressure, gauge	**6**	Current gauge pressure reading
Pressure, gauge maximum (8v32)	**183**	Highest gauge pressure since reset
Pressure, gauge minimum (8v32)	**182**	Lowest gauge pressure since rese
Pressure, gauge setpoint	**38**	Setpoint for gauge pressure
Pressure, gauge setpoint error (8v00)	**181**	Gauge pressure minus the ramp-limited setpoint
Pressure, second absolute (7v01)	**344**	For devices with a pressure sensor in a second location, the absolute pressure of the second sensor.
Pressure, second absolute maximum (8v32)	**351**	Highest second absolute pressure since reset

Pressure statistic	Value	Notes
Pressure, second absolute minimum (8v32)	**350**	Lowest second absolute pressure since reset
Pressure, second absolute setpoint (7v01)	**345**	Setpoint for the second absolute pressure.
Pressure, second absolute setpoint error (8v00)	**349**	Second absolute pressure minus the ramp-limited setpoint.
Pressure, second differential (7v01)	**360**	For devices with a pressure sensor in a second location, the differential pressure of the second sensor.
Pressure, second differential maximum (8v32)	**367**	Highest second differential pressure since reset
Pressure, second differential minimum (8v32)	**366**	Lowest second differential pressure since reset
Pressure, second differential setpoint (7v01)	**361**	Setpoint for the second differential pressure
Pressure, second differential setpoint error (8v00)	**365**	Second differential pressure minus the ramp-limited setpoint
Pressure, second gauge (7v01)	**352**	For devices with a pressure sensor in a second location, the gauge pressure of the second sensor. For DILO, this is the pressure upstream of the orifice.
Pressure, second gauge maximum (8v32)	**359**	Highest second gauge pressure since reset
Pressure, second gauge minimum (8v32)	**358**	Lowest second gauge pressure since reset
Pressure, second gauge setpoint (7v01)	**353**	Setpoint for the second gauge pressure
Pressure, second gauge setpoint error (8v00)	**357**	Second gauge pressure minus the ramp-limited setpoint

Appendix A-3: Other Statistics

Other statistic	Value	Notes
None	**1**	No statistic: usually implies an empty location.
Setpoint	**32**	The current ramp-limited setpoint. When specified in a location, the currently active setpoint statistic replaces this statistic.
Setpoint error (8v00)	**133**	Current process value minus the ramp-limited setpoint
Status	**26**	The status of the device. This is typically only used internally.
Temperature, stream	**3**	Current stream temperature
Temperature, stream maximum (8v32)	**159**	Highest stream temperature since reset.
Temperature, stream minimum (8v32)	**158**	Lowest stream temperature since reset
Valve drive	**13**	Valve drive signal
Valve drive setpoint (8v00)	**45**	The setpoint directly drives the currently selected valve.
Vapor fraction (Percent water vapor)	**488**	The molecular fraction of vapor in gas. When the vapor used is water, this is the percentage of water vapor.
Vapor fraction maximum	**495**	Highest vapor fraction since reset
Vapor fraction minimum	**494**	Lowest vapor fraction since reset
Vapor saturation (relative humidity)	**25**	The fraction of complete saturation the device is currently using. When the vapor used is water, this is relative humidity.
Vapor saturation, average	**89**	Average vapor saturation over the time of totalizing
Vapor saturation, maximum (8v32)	**335**	Highest vapor saturation since reset
Vapor saturation, minimum (8v32)	**334**	Lowest vapor saturation since last reset
Vapor saturation, peak	**121**	Peak vapor saturation over the time of totalizing
Vapor saturation, temperature (dew point)	**496**	Temperature that would result in complete vapor saturation. When the vapor used is water, this is the dew point.
Vapor saturation, temperature, maximum	**503**	Highest vapor saturation temperature since reset
Vapor saturation, temperature, minimum	**502**	Lowest vapor saturation temperature since reset

Appendix B: Engineering Units

The following tables provide the values for engineering units for use in commands. The table to refer to is dependent on the statistic that is being modified. For example, use Appendix B-3 when modifying the engineering units for a totalizer measuring standard or normal volumes.

Appendix B-1: Standard and Normal Flow Units

Unit Label	Value	Notes
	0	Unit not specified: use default values.
---	1	Unknown unit: no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
SµL/m	2	Standard microliter per minute
SmL/s	3	Standard milliliter per second
SmL/m	4	Standard milliliter per minute
SmL/h	5	Standard milliliter per hour
SL/s	6	Standard liter per second
SLPM	7	Standard liter per minute
SL/h	8	Standard liter per hour
SCCS	11	Standard cubic centimeter per second
SCCM	12	Standard cubic centimeter per minute
Scm^3/h	13	Standard cubic centimeter per hour
Sm^3/m	14	Standard cubic meter per minute
Sm^3/h	15	Standard cubic meter per hour
Sm^3/d	16	Standard cubic meter per day
Sin^3/m	17	Standard cubic inch per minute
SCFM	18	Standard cubic foot per minute
SCFH	19	Standard cubic foot per hour
SCFD	21	Standard cubic foot per day Added in 6v08.0.
kSCFM	20	1000 standard cubic feet per minute
NµL/m	32	Normal microliter per minute
NmL/s	33	Normal milliliter per second
NmL/m	34	Normal milliliter per minute
NmL/h	35	Normal milliliter per hour
NL/s	36	Normal liter per second
NLPM	37	Normal liter per minute
NL/h	38	Normal liter per hour
NCCS	41	Normal cubic centimeter per second
NCCM	42	Normal cubic centimeter per minute
Ncm^3/h	43	Normal cubic centimeter per hour
Nm^3/m	44	Normal cubic meter per minute
Nm^3/h	45	Normal cubic meter per hour
Nm^3/d	46	Normal cubic meter per day
Count	62	Setpoint count, 0–64000
%	63	Percent of the full scale

Appendix B-2: True Mass Flow Units

Unit Label	Value	Notes
mg/s	64	Milligram per second
mg/m	65	Milligram per minute
g/s	66	Gram per second
g/m	67	Gram per minute
g/h	68	Gram per hour
kg/m	69	Kilogram per minute
kg/h	70	Kilogram per hour
oz/s	71	Ounce per second
oz/m	72	Ounce per minute
lb/m	73	Pound per minute
lb/h	74	Pound per hour

Appendix B-3: Total Standard and Normal Volume Units

Unit Label	Value	Notes
	0	Unit not specified: use default values.
---	1	Unknown unit: no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
SµL	2	Standard microliter
SmL	3	Standard milliliter
SL	4	Standard liter
Scm^3	6	Standard cubic centimeter
Sm^3	7	Standard cubic meter
Sin^3	8	Standard cubic inch
Sft^3	9	Standard cubic foot
kSft^3	10	1000 standard cubic feet
NµL	32	Normal microliter
NmL	33	Normal milliliter
NL	34	Normal liter
Ncm^3	36	Normal cubic centimeter
Nm^3	37	Normal cubic meter

Appendix B-4: Volumetric Flow Units

Unit Label	Value	Notes
	0	Unit not specified: use default values.
---	1	Unknown unit: no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
µL/m	2	Microliter per minute
mL/s	3	Milliliter per second
mL/m	4	Milliliter per minute
mL/h	5	Milliliter per hour
L/s	6	Liter per second
LPM	7	Liter per minute
L/h	8	Liter per hour

Unit Label	Value	Notes
US GPM	9	US gallon per minute
US GPH	10	US gallon per hour
CCS	11	Cubic centimeter per second
CCM	12	Cubic centimeter per minute
cm^3/h	13	Cubic centimeter per hour
m^3/m	14	Cubic meter per minute
m^3/h	15	Cubic meter per hour
m^3/d	16	Cubic meter per day
in^3/m	17	Cubic inch per minute
CFM	18	Cubic foot per minute
CFH	19	Cubic foot per hour
CFD	21	Cubic foot per day Added in 6v08.0.
count	62	Setpoint count, 0–64000
%	63	Percent of full scale

Appendix B-5: Total Volume Units

Unit Label	Value	Notes
	0	Unit not specified: use default values.
---	1	Unknown unit: no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
µL	2	Microliter
mL	3	Milliliter
L	4	Liter
US GAL	5	US gallon
cm^3	6	Cubic centimeter
m^3	7	Cubic meter
in^3	8	Cubic inch
ft^3	9	Cubic foot
µP	61	Micropoise, a measure of viscosity: no conversions are performed to or from other units

Appendix B-6: Pressure Units

Unit Label	Value	Notes
	0	Unit not specified: use default values.
---	1	Unknown unit: no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
Pa	2	Pascal
hPa	3	Hectopascal
kPa	4	Kilopascal
MPa	5	Megapascal
mbar	6	Millibar
bar	7	Bar
g/cm^2	8	Gram force per square centimeter
kg/cm	9	Kilogram-force per square centimeter
PSI	10	Pound-force per square inch
PSF	11	Pound-force per square foot
mTorr	12	Millitorr
torr	13	Torr
mmHg	14	Millimeter of mercury at 0 °C
inHg	15	Inches of mercury at 0 °C
mmH_2O	16	Millimeter of water at 4 °C (NIST conventional)
mmH_2O	17	Millimeter of water at 60 °F
cmH_2O	18	Centimeter of water at 4 °C (NIST conventional)
cmH_2O	19	Centimeter of water at 60 °F
inH_2O	20	Inch of water at 4 °C (NIST conventional)
inH_2O	21	Inch of water at 60 °F
atm	22	Atmosphere (absolute pressure only, no A/G/D suffix is applied)
V	61	Volt: no conversions are performed to or from other units (intended only for log-linear absolute pressure sensors, no A/G/D suffix is applied)
count	62	Setpoint count, 0–64000
%	63	Percent of full scale (no A/G/D suffix is applied)

Appendix B-7: Temperature Units

Unit Label	Value	Notes
	0	Unit not specified: use default values.
---	1	Unknown unit: no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
°C	2	Degree Celsius
°F	3	Degree Fahrenheit
°K	4	Kelvin
°Ra	5	Degree Rankine

Appendix B-8: Time Interval Units

Unit Label	Value	Notes
	0	Unit not specified: use default values.
---	1	Unknown unit: no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
h:m:s	2	The value displayed as hours:minutes:seconds.
ms	3	Millisecond
s	4	Second
m	5	Minute
hour	6	Hour
day	7	Day

Appendix C: Device Data Sources

Use the following table to determine the data source of a given value.

Data Source	Value	Notes
Instant display	**1**	Data source on the device. Smoothed for front panel display.
Instant serial	**2**	Data source on the device. Smoothed for serial values.
Totalizer 2	**25**	Readings taken from the second totalizer.

Appendix D: Gas Numbers

#	Short Name	Long Name
0	Air	Air (Clean Dry)
1	Ar	Argon
2	CH_4	Methane
3	CO	Carbon Monoxide
4	CO_2	Carbon Dioxide
5	C_2H_6	Ethane
6	H_2	Hydrogen
7	He	Helium
8	N_2	Nitrogen
9	N_2O	Nitrous Oxide
10	Ne	Neon
11	O_2	Oxygen
12	C_3H_8	Propane
13	nC_4H_{10}	Normal Butane
14	C_2H_2	Acetylene
15	C_2H_4	Ethylene (Ethene)
16	iC_4H_{10}	Isobutane
17	Kr	Krypton
18	Xe	Xenon
19	SF_6	Sulfur Hexafluoride[1]
20	C-25	25% CO_2, 75% Ar
21	C-10	10% CO_2, 90% Ar
22	C-8	8% CO_2, 92% Ar
23	C-2	2% CO_2, 98% Ar
24	C-75	75% CO_2, 25% Ar
25	He-25	25% He, 75% Ar
26	He-75	75% He, 25% Ar
27	A1025	90% He, 7.5% Ar, 2.5% CO_2
28	Star29	Stargon CS (90% Ar, 8% CO_2, 2% O_2)
29	P-5	5% CH_4, 95% Ar
30	NO	Nitric Oxide[2]
31	NF_3	Nitrogen Trifluoride[2]
32	NH_3	Ammonia[2]
33	Cl_2	Chlorine[2]
34	H_2S	Hydrogen Sulfide[2]
35	SO_2	Sulfur Dioxide[2]
36	C_3H_6	Propylene[2]
80	1Buten	1-Butylene[2]
81	cButen	Cis-Butene (cis-2-Butene)[2]
82	iButen	Isobutene[2]
83	tButen	Trans-2-Butene[2]
84	COS	Carbonyl Sulfide[2]
85	DME	Dimethylether (C_2H_6O)[2]
86	SiH_4	Silane[2]
100	R-11	Trichlorofluoromethane (CCl_3F)[2,3]

#	Short Name	Long Name
101	R-115	Chloropentafluoroethane (C_2ClF_5)[2,3]
102	R-116	Hexafluoroethane (C_2F_6)[2]
103	R-124	Chlorotetrafluoroethane (C_2HClF_4)[2,3]
104	R-125	Pentafluoroethane (CF_3CHF_2)[2,3]
105	R-134A	Tetrafluoroethane (CH_2FCF_3)[2,3]
106	R-14	Tetrafluoromethane (CF_4)[2]
107	R-142b	Chlorodifluoroethane (CH_3CClF_2)[2,3]
108	R-143a	Trifluoroethane ($C_2H_3F_3$)[2,3]
109	R-152a	Difluoroethane ($C_2H_4F_2$)[2]
110	R-22	Difluoromonochloromethane ($CHClF_2$)[2,3]
111	R-23	Trifluoromethane (CHF_3)[2,3]
112	R-32	Difluoromethane (CH_2F_2)[2,3]
113	R-318	Octafluorocyclobutane (C_4F_8)[2]
114	R-404A	44% R-125, 4% R-134A, 52% R-143A[2,3]
115	R-407C	23% R-32, 25% R-125, 52% R-143A[2,3]
116	R-410A	50% R-32, 50% R-125[2,3]
117	R-507A	50% R-125, 50% R-143A[2,3]
140	C-15	15% CO_2, 85% Ar
141	C-20	20% CO_2, 80% Ar
142	C-50	50% CO_2, 50% Ar
143	He-50	50% He, 50% Ar
144	He-90	90% He, 10% Ar
145	Bio5M	5% CH_4, 95% CO_2
146	Bio10M	10% CH_4, 90% CO_2
147	Bio15M	15% CH_4, 85% CO_2
148	Bio20M	20% CH_4, 80% CO_2
149	Bio25M	25% CH_4, 75% CO_2
150	Bio30M	30% CH_4, 70% CO_2
151	Bio35M	35% CH_4, 65% CO_2
152	Bio40M	40% CH_4, 60% CO_2
153	Bio45M	45% CH_4, 55% CO_2
154	Bio50M	50% CH_4, 50% CO_2
155	Bio55M	55% CH_4, 45% CO_2
156	Bio60M	60% CH_4, 40% CO_2
157	Bio65M	65% CH_4, 35% CO_2
158	Bio70M	70% CH_4, 30% CO_2
159	Bio75M	75% CH_4, 25% CO_2
160	Bio80M	80% CH_4, 20% CO_2
161	Bio85M	85% CH_4, 15% CO_2
162	Bio90M	90% CH_4, 10% CO_2
163	Bio95M	95% CH_4, 5% CO_2
164	EAN-32	32% O_2, 68% N_2
165	EAN-36	36% O_2, 64% N_2
166	EAN-40	40% O_2, 60% N_2
167	HeOx20	20% O_2, 80% He
168	HeOx21	21% O_2, 79% He
169	HeOx30	30% O_2, 70% He
170	HeOx40	40% O_2, 60% He

#	Short Name	Long Name
171	HeOx50	50% O_2, 50% He
172	HeOx60	60% O_2, 40% He
173	HeOx80	80% O_2, 20% He
174	HeOx99	99% O_2, 1% He
175	EA-40	Enriched Air-40% O_2
176	EA-60	Enriched Air-60% O_2
177	EA-80	Enriched Air-80% O_2
178	Metab	Metabolic Exhalant (16% O_2, 78.04% N_2, 5% CO_2, 0.96% Ar)
179	LG-4.5	4.5% CO_2, 13.5% N_2, 82% He
180	LG-6	6% CO_2, 14% N_2, 80% He
181	LG-7	7% CO_2, 14% N_2, 79% He
182	LG-9	9% CO_2, 15% N_2, 76% He
183	HeNe-9	9% Ne, 91% He
184	LG-9.4	9.4% CO_2, 19.25% N_2, 71.35% He
185	SynG-1	40% H_2, 29% CO, 20% CO_2, 11% CH_4
186	SynG-2	64% H_2, 28% CO, 1% CO_2, 7% CH_4
187	SynG-3	70% H_2, 4% CO, 25% CO_2, 1% CH_4
188	SynG-4	83% H_2, 14% CO, 3% CH_4
189	NatG-1	93% CH_4, 3% C_2H_6, 1% C_3H_8, 2% N_2, 1% CO_2
190	NatG-2	95% CH_4, 3% C_2H_6, 1% N_2, 1% CO_2
191	NatG-3	95.2% CH_4, 2.5% C_2H_6, 0.2% C_3H_8, 0.1% C_4H_{10}, 1.3% N_2, 0.7% CO_2
192	CoalG	50% H_2, 35% CH_4, 10% CO, 5% C_2H_4
193	Endo	75% H_2, 25% N_2
194	HHO	66.67% H_2, 33.33% O_2
195	HD-5	LPG: 96.1% C_3H_8, 1.5% C_2H_6, 0.4% C_3H_6, 1.9% n-C_4H_{10}
196	HD-10	LPG: 85% C_3H_8, 10% C_3H_6, 5% n-C_4H_{10}
197	OCG-89	89% O_2, 7% N_2, 4% Ar
198	OCG-93	93% O_2, 3% N_2, 4% Ar
199	OCG-95	95% O_2, 1% N_2, 4% Ar
200	FG-1	2.5% O_2, 10.8% CO_2, 85.7% N_2, 1% Ar
201	FG-2	2.9% O_2, 14% CO_2, 82.1% N_2, 1% Ar
202	FG-3	3.7% O_2, 15% CO_2, 80.3% N_2, 1% Ar
203	FG-4	7% O_2, 12% CO_2, 80% N_2, 1% Ar
204	FG-5	10% O_2, 9.5% CO_2, 79.5% N_2, 1% Ar
205	FG-6	13% O_2, 7% CO_2, 79% N_2, 1% Ar
206	P-10	10% CH_4 90% Ar
210	D-2	Deuterium

1 *Sulfur hexafluoride is a highly potent greenhouse gas monitored under the Kyoto Protocol.*

2 *Corrosive-resistant units only*

3 *Under the Montreal Protocol and Kigali Amendment, the production and consumption of these ozone-depleting substances (ODS) is being or has been phased out. It is recommended you ensure compliance with this universally ratified treaty before attempting to use these gases, in addition to R113, R-123, and R-141b.*