

# EtherNet/IP Operating Bulletin



# RECALIBRATION

Your Alicat instrument is a precision device and Alicat strongly recommends that you send it to us on a yearly basis for recalibration.

A yearly recalibration does a few things:

- ► It ensures that your unit is functioning according to specification.
- Contamination may cause the instrument to measure flow improperly. Recalibration ensures the instrument is clean and free of debris.
- Recalibration maintains your LIFETIME WARRANTY!

Sending your unit for recalibration is easy and inexpensive. Recalibrations are usually shipped within five days of receipt, so it's fast too.

Please keep the original box to return your Alicat instrument for recalibration.



2022-09-20 • Rev 4 • DOC-MAN-ETHERNET-IP

# **ALICAT EtherNet/IP™ OPERATING BULLETIN**

# Table of Contents

Physical Design and User Interface	page 4
Physical Packaging.	
Ports and Status Lights.	
Communications Menu Changes	
EtherNet/IP™ Communication	page 5
Explicit Messaging I/O	
Assembly 100 - Setpoint	
Assembly 101 - Device Readings	
Mass Flow Controller Default	
Mass Flow Meter Default	
Pressure Gauge Default	
Pressure Controller Default	
Assembly 102-104 - Device Commands	
COMPOSER <sup>™</sup> Personalized Mixed Gas Compositions	
Network Configuration	page 12
IP Address Configuration	
Configuring a Network Card for DHCP Operation.	
Assigning an IP Using Rockwell Automation's BootP-DHCP Tool.	
Assigning an IP using TFTPD64	
Assigning a Static IP	
Using The Embedded Webserver	page 16
The Home Page:	
The Data I/O Page	
The Network Config Page	
The Device Config Page	
Rockwell PLC Setup	page 19
Determining Assembly 101 Input Size	
Creating an Alicat Module	
Creating a Module from the EDS	
Creating a Generic Ethernet Module	
Formatting I/O Data	
Changing The Setpoint	

Sending a Command

# ALICAT EtherNet/IP<sup>™</sup> OPERATING BULLETIN

# **Physical Design and User Interface**

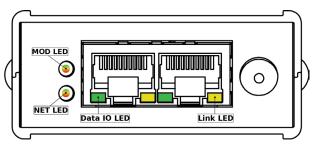
This operating bulletin is designed to be used in conjunction with a manual for your type of Alicat device. Physical manuals are usually provided with your device. Digital copies can also be downloaded at our website at <u>www.alicat.com/manuals</u>.

#### **Physical Packaging**

Alicat EtherNet/IP devices have taller electronics assemblies to accommodate the communications adapter that enables Ethernet/IP control. CAD files for your specific device are available and can be obtained by contacting an Alicat applications engineer.

#### **Ports and Status Lights**

All Alicat EtherNet/IP<sup>™</sup> devices come equipped with two RJ45 ports, located on top of the device. These can be used to daisy chain devices or establish a ring topology network. Both ports can be used interchangeably to connect the device to a network.



When an active link is established on a port the yellow link LED on that port will light up. The green data IO LED will flash when data is being transmitted over that link.

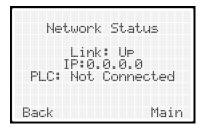
Additionally there are two multicolored red/green LEDs opposite the power jack, the MOD and Net LEDs. These indicate specific things about your system status as indicated by the table below:

LED status	MOD LED	NET LED
Off	Device not Powered	No IP Address Assigned
Steady Green	Device Operational	Ethernet/IP 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

#### **Communications Menu Changes**

Ethernet/IP devices will have a slightly different communications menu than the one indicated by the operating manual for your device.

To access this menu from the front panel of the device press MENU> ADV SETUP > COMM STATUS. This menu will display network status information and can be used to troubleshoot/diagnose communications issues.



# EtherNet/IP<sup>™</sup> Communication

Alicat devices support the EtherNet/IP<sup>™</sup> protocol as a communications adapter (device type 12). The following sections describe the data format available through CIP explicit messages or cyclic I/O. The EDS for your Alicat device can be downloaded directly from the CIP file object (Class 0x37, Instance 200) or from <u>alicat.com/eip</u>.

#### **Explicit Messaging I/O**

Identity Object - Class 1, Instance 1 Attrib Name Access Comment Type 1 Vendor ID UINT Get 1174 2 12 Device Type UINT Get 2 3 Product Code UINT Get STRUCT 4 Revision Get Major.Minor 5 Status WORD Get 6 Serial Number UDINT Get 7 Product Name STRING Get

The following objects and attributes are supported. All objects support the Get\_Attribute\_ Single and Set\_Attribute\_Single service in addition to any other specified services.

Message Router - Class 2, Instance 1				
Attrib	Name	Туре	Access	Comment
1	Object list	STRUCT	Get	
2	Number available	UINT	Get	

Assembly Object - Class 4				
Attrib	Name	Туре	Access	Comment
3	Data	ARRAY	Get/Set	See instance descriptions below
4	Size	USINT	Get	Size of attrib 3

See the following sections for a list of supported assemblies.

Connection Manager - Class 6, Instance 1				
Attrib	Name	Туре	Access	Comment
1	Open Requests	UINT	Set	
2	Open Format Rejects	UINT	Set	
3	Open Resource Rejects	UINT	Set	
4	Open Other Rejects	UINT	Set	
5	Close Requests	UINT	Set	
6	Close Format Rejects	UINT	Set	
7	Close Other Rejects	UINT	Set	
8	<b>Connection Timeouts</b>	UINT	Set	

	Connection Manager Services			
Code	Name	Description		
0x4E	Forward_Close	Closes a connection.		
0x52	Unconnected_Send	Unconnected message request.		
0x54	Forward_Open	Opens a connection.		
0x5A	Get_Connection_Owner	Returns data about a connection.		
0x5B	Large_Forward_Open	Opens a connection.		

#### Assembly 100 - Setpoint

The device setpoint should be sent as a 32-bit IEEE floating point value. Setpoint is ignored on devices without a controller.

Setpoint - Class 4, Instance 100, Attribute 3		
Parameter	Туре	Comment
Setpoint	REAL	

#### **Assembly 101 - Device Readings**

Your Alicat device can output up to 20 different data statistics depending on the device's configuration. Default statistics for each device type are specified in sections 1.3.1 through 1.3.4 below. Each statistic present will increase the size of the assembly. Assembly size can be determined by doing an explicit messaging read of the assembly size attribute – class 4, instance 101, attribute 4.

The configured data statistics for assembly 101 can be viewed by directly connecting to the embedded web server of the device and clicking on the tab labeled "Data IO". (See page 12 for information on assigning an IP and connecting to the web server.)

The value returned for a pressure reading can be absolute pressure, gauge pressure or differential pressure, depending on your device's configuration. If you wish to customize the format and the displayed readings of your device, please speak to an Alicat applications engineer.

Device status conditions in the device are specified below. Values in parenthesis are displayed on the display panel of the device. The device status is output as a 32-bit DWORD. At the present time, bits 13-31 are reserved and should read as zero.

Bit	Description
0	Temperature Overflow (TOV)
1	Temperature Underflow (TOV)
2	Volumetric Overflow (VOV)
3	Volumetric Underflow (VOV)
4	Mass Overflow (MOV)
5	Mass Underflow (MOV)
6	Pressure Overflow (POV)
7	Totalizer Overflow (OVR)
8	PID Loop in Hold (HLD)
9	ADC Error (ADC)
10	PID Exhaust (EXH)
11	Over Pressure Limit (OPL)
12	Flow Overflow During Totalize (TMF)

## **Mass Flow Controller**

Reading Number	Statistic
1	Pressure
2	Flow Temperature
3	Volumetric Flow
4	Mass Flow
5	Mass Flow Setpoint
6	Mass Total*

#### **Mass Flow Meter**

Reading Number	Statistic
1	Pressure
2	Flow Temperature
3	Volumetric Flow
4	Mass Flow
5	Mass Total*

# **Pressure Gauge**

Reading Number	Statistic
1	Pressure

#### **Pressure Controller**

Reading Number	Statistic
1	Pressure
2	Pressure Setpoint

\* Mass total will only appear on devices configured with a totalizer.

#### Assembly 102-104 - Device Commands

Commands are issued to your Alicat device through assembly instance 102. A command is initiated on a write to instance 102. The result of the last command can be then be read in instance 103.

Command Request - Class 4, Instance 102, Attribute 3			
Parameter Type Comment			
Command ID	UINT	See Page 10 For Valid Commands	
Command Argument	UINT		

Command Result - Class 4, Instance 103, Attribute 3			
Parameter Type Description			
Command ID	UINT	ID of last command.	
Command Status	UINT	Status of last command.	

Please note that commands are processed when the values in instance 102 change. Passing repeated, identical command IDs and arguments to instance 102 will not change the value, so these commands will be ignored. To send sequential identical commands zeros should passed to instance 102, attribute 3 between commands. If you are using Alicat's provided add-on instruction sets (see page 13), then this procedure is handled automatically.

A table of commands can be found on the next page. Depending on your device's firmware version and configuration, not all commands will be valid. Your device's firmware version and other device information can be found by accessing the "Device Info" tab on the device's internal webserver. See page 13 for more details.

CmdID	Action	Argument	Notes
1	Change Selected Gas	0 to 255 – Selected Gas Index	Gas select commands only valid on mass flow instruments.
2	Gas Mix	0 – Use Next Open Index Position 236 to 255 – Specify a mix index	Creates or updates a custom gas mix calibrations from inputs to instance 104 attribute 3 (see page 11).
3	Delete Gas Mixture	236-255 – Mix Index	Will not allow deletion of non-custom gas mixtures.
4	Tare	0 – Tare Pressure 1 – Tare Absolute Pressure 2 – Tare Flow	Argument 0 only valid for gauge and differential pressure devices. Argument 1 only valid for devices with –IB part number. Argument 2 only valid for flow instruments.
5	Reset Totalizer	0 – No Argument Necessary	Only valid for mass or liquid flow instruments with a totalizer.
6	Valve Hold	0 – Cancel Current Holds 1 – Hold Valves Closed 2 – Hold Valves at Current Position 3 – Hold Exhaust Valve Open	Only valid for controllers. Hold commands stop all closed loop valve control. Argument 3 is only available on multi-valve instruments.
7	Display Lock	0 – Lock Display 1 – Unlock Display	Only valid for devices with displays. Locking the display prevents changing device settings from the front panel. Menus can still be navigated and settings viewed with display locked.
8	Set PID Proportional Gain	0 to 65535 – P Gain	PID settings only valid for controllers.
9	Set PID Differential Gain	0 to 65535 – D Gain	PID settings only valid for controllers.
10	Set PID Integral Gain	0 to 65535 – I Gain	Integral value only valid when using PD2I algorithm. See user manual for details.
11	Set PID Loop Variable	0 – Mass Flow 1 – Volumetric Flow 2 – Differential Pressure 3 – Absolute Pressure 4 – Gauge Pressure	Depending on the available sensor inputs, not all loop variables will be available.
12	Save Power-Up Setpoint	0 – No Arguments	Save current setpoint to EEPROM. EEPROM has limited write cycles. Avoid code loops which generate fast, repeated EEPROM writes. Only valid for controllers.
13	Set PID Loop Algorithm	0 – Use PDF algorithm 1 – Use PD2I algorithm	Only valid for controllers with firmware version 7v08 or greater. PDF recommended for single valve devices. PD2I recommended for dual valve devices.
14	Read PID value	0 – Return P Gain 1 – Return D Gain 2 – Return I Gain	Only valid for controllers with firmware version 7v08 or greater. After command is sent the values can read as the command status from instance 103, attribute 3.
15	Select Active Valve	0 – Select Valve 1 1 – Select Valve 2	Only valid for MCT series 3 valve controllers with firmware versions 7v16 or higher.

Status	Description
0	Success
0x8001	Invalid command ID
0x8002	Invalid setting
0x8003	Requested feature is unsupported
0x8004	Invalid gas mix index
0x8005	Invalid gas mix constituent
0x8006	Invalid gas mix percentage
0x0001 to 0xFFFF	Process value. Command 14 will return current PID values in hexadecimal format as command status values. These may overlap status codes depending on the value.

#### **COMPOSER™** Personalized Mixed Gas Compositions

Custom gas mixtures can be configured with 2-5 gases using the mix assembly. The mix is a two-step process. First, the desired constituent gas indexes and percentages must be written to the mix assembly followed by a write of the Mix Gas command (ID 2) into command assembly. Assembly 104 accepts a 20 byte input, structured according to the following table:

Gas Mix - Class 4, Instance 104, Attribute 3		
Parameter	Туре	Notes
Mixture Gas 1 Index	UINT	
Mixture Gas 1 %	UINT	
Mixture Gas 2 Index	UINT	
Mixture Gas 2 %	UINT	
Mixture Gas 3 Index	UINT	
Mixture Gas 3 %	UINT	
Mixture Gas 4 Index	UINT	
Mixture Gas 4 %	UINT	
Mixture Gas 5 Index	UINT	
Mixture Gas 5 %	UINT	

All 20 bytes must be passed to the assembly, and all gas indexes must be valid gas index numbers. See product manual for a list of indices. A combination of mixtures can be created by using an existing gas mixture index, 236-255. However, the accuracy of the flow calculations may degrade with complex mixtures of gases with dissimilar chemical properties.

Gas mix percentages are interpreted as integer hundredths of a percent and the total percentage must sum to 100%. The mix will be performed with the first N gases that have a non-zero percentage.

Once a valid gas mixture is defined in assembly 104, a new gas mixture index will be created by passing command id 2 to instance 102, assembly 3. If one of the requested mix gas indices does not exist, or the sum of gas percentages does not equal 100%, an error will be returned in assembly 103 and the command will fail.

If the command argument passed with the mix command is 0, the new gas mix index will be stored in the next empty index, starting at 255 and working down to 236. If all gas mix indices are in use, the command will fail and an error will be returned in assembly 103. If the command argument passed is between 236 and 255, the specified index will be either created or updated to the new composition. If the index specified is not valid (the command argument is neither 0 nor 236-255), the command will fail and an error will be returned in assembly 103.

For example, to create a mixture of 50% argon (gas index 2), 25% nitrogen (gas index 9), and 25% oxygen (gas index 11) and assign it to gas index 244, pass the following input to assembly 104, attribute 3:

Parameter	Value	Notes
First Gas Index (byte offset 0)	2	Argon Index
First Gas Percent (byte offset 2)	5000	In 100ths of a %
Second Gas Index (byte offset 4)	9	Nitrogen Index
Second Gas Percent (byte offset 6)	2500	In 100ths of a %
Third Gas Index (byte offset 8)	11	Oxygen Index
Third Gas Percent (byte offset 10)	2500	In 100ths of a %
Fourth Gas Index (byte offset 12)	1	Any valid gas index
Fourth Gas Percent (byte offset 14)	0	0% values ignored
Fifth Gas Index (byte offset 16)	1	Any valid gas index
Fifth Gas Percent (byte offset 18)	0	0% values ignored

# **Network Configuration**

Alicat devices have two 10/100Mbps Ethernet ports with an embedded switch. Either port can be used in a star topology network configuration. For linear or ring topologies, one port can be used as the input and one port as the output to daisy chain devices together. Device Level Ring (DLR) is also supported to build failsafe network rings.

# **IP Address Configuration**

The out-of-the-box configuration of your device uses DHCP to obtain an IP address. The IP settings can be changed using either the TCP/IP CIP object or through the device's embedded web server. To do so, you must first assign an address using DHCP.

#### **Configuring a Network Card for DHCP Operation**

All the following instructions rely on a network interface with a static IP address being available to the Alicat device. To assign a static IP, first open the settings for the network adapter you are using to interact with your PLC network or device and assign a static IP/ disable DHCP.

In Windows, navigate to the control panel, select "View Network Connections", right click the icon of the network adapter you are using, and click "Properties". Within the properties window scroll through the list of installed protocols and find the entry "Internet Protocol Version 4". Click it, and click "Properties" to open the following window:

Internet Protocol Version 4 (TCP/IPv	4) Properties	? ×
General		
You can get IP settings assigned autom this capability. Otherwise, you need to for the appropriate IP settings.		
Obtain an IP address automatical	ly	
• Use the following IP address:		[]
IP address:	192.168.2.10	
Subnet mask:	255.255.255.0	
Default gateway:		
C Obtain DNS server address auton	natically	
└ Use the following DNS server add	resses:	
Preferred DNS server:		
Alternate DNS server:		
Validate settings upon exit	Advanced.	
	OK Car	ncel

Assign a static IP by selecting "use the following IP addres" and typing in the desired IP address and subnet mask.

#### Assigning an IP using Rockwell Automation's BootP-DHCP Tool

Disable or disconnect all network interfaces, except for the interface you are using as your DHCP server. Then launch the BootP-DHCP tool from the start menu.

The first time this software is launched, you will be prompted to enter your network settings. At a minimum, you will need to define a Subnet mask, which will be the same mask you defined in previous section. In our example the mask value of 255.255.255.0 was used. Once your network settings are entered, click "OK" to return to the main window.

In this window, double click the MAC address of the Alicat you wish to assign an IP. On the next screen enter an IP address and click OK. Hostname and description are optional. The MAC address of your Alicat device can be found on the calibration sticker on the back of the device.

#### Assigning an IP using TFTPD64

This example uses the open source Tftpd64 tool available at tftpd32.jounin.net.

Launch Tftpd64 and click the settings button in the lower middle of the screen. From the newly launched settings window, click the DHCP tab.

🏷 Tftpd32: Settings			X
GLOBAL TETP DE	ICP SYSLOG		
DHCP Pool definition			
IP pool starting addres:	\$ 192.168.2.100		
Size of pool	1		
Boot File			
WINS/DNS Server	0.0.0.0		
Default router	0.0.0.0		
Mask	255.255.255.0		
Domain Name			
Additional Option			
DHCP Options			
Ping address befo	-		
Bind DHCP to this	address	192.168.2.10	) 💽
Persistant leases			
	refault	Help	Cancel
		neip	Cancer

The settings pictured in this screenshot configure the DHCP server on an adapter with a static IP of 192.168.2.10.

Once TFTPD is configured as a DHCP server, connect your Alicat directly to the same network as the PC and adapter running TFTPD, and supply power to the Alicat. After a few moments, an address should be allocated to the device by the DHCP server.

🎨 Tftpd32 by Ph	. Jounin		
Current Directory		•	Browse
Server interface	192.168.2.10	•	Show Dir
DHCP server Lo	og viewer		
allocated at	IP	MAC	renew at
11/20 12:50:30	192.168.2.50	E1:6C:D6:AE:52	
•			

#### **Assigning a Static IP with EIP Tools**

If DHCP is left enabled on the Alicat, then a new IP address will need to be assigned every time the device is power cycled. To prevent this, disable DHCP and assign a static IP address to the device.

The following shows how to use EIP\_Tools, a free program available from molex, to send EIP explicit messages to the device and disable DHCP.

Launch EIP tools from the start menu. Enter the Alicat's IP address in the station field at the top left, and click on the tab labelled 0xF5 TCP/IP. From here, click Get\_Attribute\_ All to populate the fields with the device's current settings:

Status : poor List Lidentity Exploite Message Class 0x01 Lidentity 0x06 Connection Manager 0x47 DLR 0x48 QoS 0xF5 TCP/IP 0xF6 Ethernet Link Instance 1 C Get_Attribute_AI Status (att 1) Interface Configuration Status C Noto Configuration Pending Interface Confi	EtherNet/IP Tools from Molex Inc. is provided fr	ee of charge to ODVA		_0_
Jatus / pack         List Lidentity / Exploite Message (Lass 0.001 Lidentity / 0x06 Connection Manager 0x47 DLR 0x48 Qas 0x45 TCP/IP 0x56 Ethemet Link /         Instance 1 Configuration Status         Interface Configuration Status         Physical Link (att 4)	Station : 192.168.2.101		ted_send Options	About molex
Instance       Image: Configuration Status       Physical Link (attr 4)         Status (attr 1)       Physical Link (attr 4)         Status (attr 1)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (0) (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (n word)         Path Size : [00000 (0) (n word)       Path Size : [00000 (n word)         Path Size : [00000000 (1)       Path Size : [00000 (n word)         PhotP Clent (P Dick CoNs Update F Interface Configuration change requires rest F Act Capable       Path Size : [00000000 (n word)         Path Size : [000000000 (10)       Path Size : [000000000 (1)       <	Status : Ok			View Log one company > a world of innovation
Status (attr 1)       Physical Link (attr 4)       Safety Network Number (attr 7) - Conditional       SelectAcd (attr 10)         Interface Configuration Status       Path Size : [0x0000 (0) (in word)       Path (attr 4)       Disable ACD       Disable ACD         Path :       [0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x0	List Identity   Explicite Message   Class   0x01 Identity	0x06 Connection Manager 0x47 DLR 0x48	QoS 0xF5 TCP/IP 0xF6 Ethernet Link	
Interface Configuration Status       Path Size : [00000 (0) (in word)         Path :       Disable ACD         Configuration Status       Get_Attribute         Path :       Get_Attribute         Configuration Capability (bit 7)       Disable ACD         Configuration Capability (bit 7)       Disable ACD <tr< td=""><td>Instance 1 Get_Attribut</td><td>te_All</td><td></td><td></td></tr<>	Instance 1 Get_Attribut	te_All		
C Hot configured       Path :	Status (attr 1)	Physical Link (attr 4)	Safety Netwok Number (attr 7) - Conditional	SelectAcd (attr 10)
C Obtamed by BOOTP, DRC or Stored Yala       1         C Valid conf dotamed by hardware settings       Get_Attribute       Get_Attribute         Most Pending       Life Configuration Rending       Get_Attribute       Get_Attribute         Most Pending       Life Configuration Rending       PAdress :       192.168.2.101         P Address :       192.168.2.101       Imme Server :       0.0.0.0         Most Pending       DHCP-ONS Update       Get_Attribute       Get_Attribute         Configuration Capability (4tr 2)       Get_Attribute       Set_Attribute       Set_Attribute         BOOTP Clent       DHCP-ONS Update       Get_Attribute       Set_Attribute       Mass Server :       0.0.0.0         Name Server :       0.0.0.0       Name Server :       0.0.0.0       Name Server :       0.0.0.0         Configuration Capability (4tr 2)       Domain Name :       Get_Attribute       Mass Control       Mass Control         Get_Attribute       Set_Attribute       Set_Attribute       Set_Attribute       Mass Control       Mass Starta Address       Get_Attribute         Get_Attribute       Set_Attribute       Set_Attribute       Set_Attribute       Set_Attribute       Operational         Mass Starta Continguration       Configuration       Operantrow       Operational <td< td=""><td>Interface Configuration Status</td><td>Path Size : 0x0000 (0) (In word)</td><td></td><td>C Disable ACD</td></td<>	Interface Configuration Status	Path Size : 0x0000 (0) (In word)		C Disable ACD
Mast Pending       UF Configuration Rending         Acd Status       Get_Attribute         Get_Attribute       Get_Attribute         Get_Attribute       Set_Attribute         Get_At	Obtained by BOOTP, DHCP or Stored Value	Path :	0x00 0x00 0x00 0x00 0x00 0x00	Enable ACD
Add Status       Interface Configuration (ditr 5)         Get_Attribute       Doc0000001 (1)         Configuration Capability (ditr 2)       Doc000001 (1)         Configuration Capability (ditr 2)       Doc000001 (1)         Configuration Capability (ditr 2)       Doc0000001 (1)         Configuration Capability (ditr 2)       Doc0000001 (1)         Configuration Capability (ditr 2)       Doc0000001 (1)         Configuration Configuration Capability (ditr 2)       Name Server : 0.0.0.0         Decc Clinter       DitrS Clent         Configuration Configuration change requires reading       Docon Clinter         Configuration Control (ditr 3)       Docon Clinter         Configuration Control (ditr 3)       Docon Clinter         Statup Configuration Control (ditr 3)       Docon Clinter         Statup Configuration Control (ditr 3)       Docon Clinter (ditr 6)         Statup Configuration       Get_Attribute         Statup Configuration       Education Control (ditr 3)         Statup Configuration       Discontrol         Statup Configuration       Discontrol         Configuration Control (ditr 3)       Discontrol         Statup Configuration       Discontrol         Get_Attribute       Discontrol         Statup Configuration       Discontrol <td><ul> <li>Valid confrobtained by hardware settings</li> </ul></td> <td>Get_Attribute</td> <td>Get_Attribute</td> <td>Get_Attribute Set_Attribute</td>	<ul> <li>Valid confrobtained by hardware settings</li> </ul>	Get_Attribute	Get_Attribute	Get_Attribute Set_Attribute
Get_Attribute       0x00000000 (1)         Production Capability (attr 2)       0x00000000 (1)         Configuration Capability (attr 2)       0x00000000 (1)         BODD Clent       DFDR S Clent         Configuration Capability (attr 2)       0x000000000 (1)         Detection Mark       Set_Attribute         Set_ODD Clent       DFDR S Clent         Detection Mark       Set_Attribute         Set_ODD Clent       Detection Mark         Detection Mark       Set_Attribute         Set_Attribute       Detection Mark         Domain Hame :       Domain Hame :         domain Mark       Domain Hame :         domain       Get_Attribute         Starting Configuration Control (attr 3)       Starting Configuration Control (attr 3)         Starting Configuration Control (attr 3)       Extended to 6         Starting Configuration Control (attr 3)       Mark (attr 6)         Starting Configuration Control (attr 3)       Mark (attr 6)         Starting Configuration Control (attr 3)       Mark (attr 6)         Starting Configuration Control (attr 12)       Mark (attr 6)         Bicat       Mark (attr 6)       Mark (attr 6)         Mark (attr 6)       Mark (attr 6)       EtherNet/IP Quid; Connect (attr 12)         Configuration			TTL Value (attr 8) - Conditional	
Configuration Capability (att 2)       Gateway Address: 192:163.1.1         BOOTC Cleft       D ROC-PAIS Update         Configuration Capability (att 2)       Gateway Address: 192:163.1.1         Name Server:       20.0.0         Mane Server:       20.0.0         Mass Configuration Control (attr 3)       Mass Server:         Structure Configuration       Configuration         Structure Configuration       Construition (attr 3)         Structure Configuration       Construct (attr 3)         Structure Configuration       Construct (attr 3)         Structure Configuration       Construct (attr 4)         Blacat       Mass Start Addres:         Get_Attribute       Set_Attribute         Get_Attribute       Configuration         Ox0000000 (0)       Mass Start Addres:         Blacat       Mass Start Addr:         Configuration       Consol         Configuration<	Get_Attribute 0x00000001 (1)			NoConflictDetected     OngoingDetection
Config. Settable       Hardware Configuration         Interface Configuration dampe requires read       Domain Name :         Get_Attribute       Oxed Configuration         Get_Attribute       Oxed Configuration         Startip Configuration       Get_Attribute         Startip Configuration       ONS Enable         Get_Attribute       Doms in Name (aftr 6)         Startip Configuration       ONS Enable         Get_Attribute       Doms in Name (aftr 6)         Startip Configuration       ONS Enable         Get_Attribute       Doms in Name (aftr 6)         Startip Configuration       ONS Enable         Get_Attribute       Doms in Name (aftr 6)         Read Start Addr :       239.192.7.64		datana) naaraba i	Get_Attribute	Remote Mac : 00 - 00 - 00 - 00 - 00 - 00
Interface Configuration change requires reset       Domain Name :         Get_Attribute       Ox00000096 (150)         Configuration Control       Ox00000096 (150)         Configuration Control (aftr 3)       Get_Attribute         Startup Configuration       Ox00000096 (150)         Other Startup Configuration       Ox00000000 (150)         Other Startup Configuration       Ox0000000 (150)         Other Startup Configuration       Ox0000000 (150)         Image: Startup Configuration       Ox0000000 (150)         Image: Startup Configuration       Ox0000000 (0)         Image: Startup Configuration       Ox000000 (0)         Image: Startup Configuration       Ox0000000 (0)         Image: Startup Configuration       Ox000000 (0)         Image: Startup Configuration       Ox0000000 (0)         Image: Startup Configuration       Ox0000000 (0)		Name Server 2 : 0.0.0.0	Mcast Config (attr 9) - Conditionnal	
Image: Configuration Control (attr 3)     Image: Configuration Control (attr 3)       Startiz Configuration Control (attr 3)     Image: Configuration Control (attr 3)       Startiz Configuration Control (attr 3)     Image: Configuration Control (attr 3)       Startiz Configuration Control (attr 3)     Image: Configuration Control (attr 3)       Startiz Configuration Control (attr 3)     Image: Configuration Control (attr 3)       Get_Attribute     Image: Configuration Control (attr 3)       Image: Configuration Control (attr 3)     Image: Configuration Control (attr 3)       Image: Configuration Control (attr 3)     Image: Configuration Control (attr 12)       Image: Configuration Control (attr 3)     Image: Configuration Control (attr 12)       Image: Configuration Control (attr 3)     Image: Configuration Control (attr 12)       Image: Configuration Control (attr 12)     Image: Configuration Control (attr 12)       Image: Configuration Control (attr 12)     Image: Configuration Control (attr 12)		Domain Name :		
Get_Attribute         0x00000096 (150)         Get_Attribute         Set_Attribute         Num Kcast and Mcast Start Address         PACOR_LEN         0           Configuration Control (attr 3)		domain		
Configuration Control (ditr 3) Sistrado radius dan Ladie dan Ladi	Get Attribute 0x00000095 (150)		-	
Startup Configuration     C Stored Value     Get_Attribute		Get_Attribute Set_Attribute	O Num Mcast and Mcast Start Address	
C BOOTP         I DNS Enable         EtherNet/IP Quid_Connect (attr 12)           C BHCP         alcat         Mcast Start Addr : 239.192.7.64         C Disable           Get_Attribute         0x0000000 (0)         Enable         0	Startup Configuration	Host Name (attr 6)	,	Get_Attribute Set_Attribute (0)
Get_Attribute         0x0000000 (0)         C         Disable         Dis			Num Mcast : 16	EtherNet/IP Quick_Connect (attr 12)
Get_Attribute 0x0000000 (0) C Enable 0	C DHCP	alicat	Mcast Start Addr : 239, 192, 7,64	Disable
Set_Attribute         Get_Attribute         Get_Attribute         Get_Attribute         Get_Attribute	Get_Attribute 0x00000000 (0)			C Enable 0
	Set_Attribute	Get_Attribute Set_Attribute	Get_Attribute Set_Attribute	Get_Attribute Set_Attribute

To disable DHCP, click the Stored Value radio button within the attribute 3 pane and click Set\_Attribute.

To assign a new IP address to the Alicat, enter your desired IP address, subnet mask, and gateway in the interface configuration pane of the window and click Set\_Attribute.

Any changes to the TCP/IP object will take effect after power cycling the device.

The network configuration can also be changed using the device's embedded webserver, as illustrated in the next section.

# **Using the Embedded Webserver**

All Ethernet/IP devices host an embedded webserver. This webserver provides identification and configuration information about your Alicat device. You can also use it to change some device settings.

To access this webserver, open a browser window from a PC on the same network as your Alicat device, and enter the IP address of the device you wish to connect to in the address bar. On connecting to the embedded webserver, the home page will load by default.

#### The Home Page

The home page gives some networking and troubleshooting information. The information here is largely for troubleshooting purposes, but the firmware version can be used to identify valid commands as defined in section 1.4.



Home Data IO Network Config

Device Config

#### Alicat Industrial Protocol Communications Adapter

#### **Device Information**

Protocol: Device FW Version: Adapter FW Version: Device Serial Num: EtherNet/IP 7v16.0-R22/IPB SC0000072-v005 4

#### **Network Status:**

MAC Address:	38:3a:21:8f:ff:ff
Address Mode:	DHCP
IP Address:	192.168.2.50
Subnet Mask:	255.255.255.0
Gateway:	192.168.2.1

## The Data I/O Page

This page lists the structure of several control assemblies and defines various device status codes.

Home				
Data IO	EtherNet/IP™ Data	a I/O Asse	mblies	
Network Config		Assemt	bly 100	
Device Config	Parameter	Туре	Description	Ξ.
	Set-point	REAL	Requested control set-point	
	NOTE: Set-point is only ap	plicable to cont	rollers.	

Assembly 101					
Parameter Type Description					
Gas	UINT	Gas Index Number			
Status	UDINT	See bitmask below			
Absolute Pressure	REAL	Reading in PSI			
Flow Temperature	REAL	Reading in °C			
Volumetric Flow	REAL	Reading in CCM			
Mass Flow	REAL	Reading in SCCM			
Mass Flow Set-point	REAL	Reading in SCCM			

	Device Status
Bit	Description
0	Temperature Overflow (TOV)
1	Temperature Underflow (TOV)
2	Volumetric Overflow (VOV)
3	Volumetric Underflow (VOV)
4	Mass Overflow (MOV)
5	Mass Underflow (MOV)
6	Pressure Overflow (POV)
7	Totalizer Overflow (OVR)
8	PID Loop in Hold (HLD)
9	ADC Error (ADC)
10	PID Exhaust (EXH)
11	Over pressure limit (OPL)
12	Flow overflow during totalize (TMF)
13	Measurement was aborted
14:31	Reserved

If you are configuring a PLC or other program to read the device's parameters, the size and structure of assembly 101 can be determined from this screen. Parameters of type REAL and UDINT are 4 byte parameters. Parameters of type UINT are 2 bytes. By summing the byte size of all the parameters listed in assembly 101, the data assembly size can be manually calculated.

#### **The Network Config Page**

This page lists the current IP and DHCP settings of your Alicat. If you prefer to disable DHCP or assign a new IP address from this page rather than by explicit messaging, simply type in your new desired values, click the DHCP checkbox to toggle the device's DHCP state, and click update.

Home		
Data IO	Alicat Indus	strial Protocol Communications Adapter
Network Config	Network Co	onfig
Device Config		-
	Use DHCP:	
	IP Address:	192.168.2.50
	Subnet Mask:	255.255.255.0
	Gateway:	192.168.2.1
	Update	

#### **The Device Config Page**

This page can be used to read and write specific, low level configuration settings of your Alicat. The Alicat serial communications primer (<u>alicat.com/documents/Alicat-Serial-Primer.pdf</u>) describes the function of common user-configurable registers.



Home Data IO	Alicat Device Configuration
Network Config	Configuration Registers
Device Config	Configuration Registers
	Use the fields below to read or write Alicat device configuration registers. For more information see your Alicat Operating Manual or speak to an Application Engineer.
	Register:
	Value:
	Read Write

Writing settings to the device can invalidate your calibration, disable communication, or even permanently damage your device. Do not write registers without a firm understanding of the changes you are making.

# **Rockwell PLC Setup**

This section shows how to setup an Alicat mass flow controller using a Rockwell ControlLogix PLC. These instructions will work for other types of Alicat device with simple alterations. In this example it is assumed that the EtherNet/IP scanner has already been configured and assigned an IP on the 192.168.2.0 subnet.

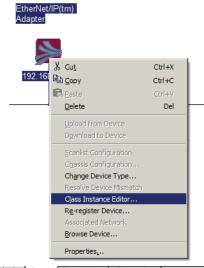
Alicat provides an Electronic Data Sheet (EDS) as well as Logix XML files with Add-On Instructions (AOIs) which can be imported into Rockwell's Logix designer in order to assist connecting to your device and mapping IO data. These can be downloaded from the Alicat website at <u>alicat.com/eip</u>.

#### **Determining Assembly 101 Input Size**

As mentioned in section 1.3 above, the size and contents of input assembly 101 vary depending on the configuration of your Alicat device. In order to create a connection you will need to define the correct input size in the connection parameters. If this is not done, you will receive an "Invalid Input Size" communications fault from the PLC.

This value can be determined from the internal webserver. (See page 17), or by explicit messaging using EIP Tools or RSNetWorx. The assembly size attribute is attribute 4. An explicit message, 0x0E: Get Attribute Single sent to path class 4, instance 103, attribute 4 will return the assembly size in hex format.

The following example shows how to use RSNetWorx to determine the assembly size. Launch RSNetworx from the computer you are using to manage your PLC. Add the Alicat to your network tree (your scanner should add itself automatically). Then right click on the Alicat device in your network tree and select "Class Instance Editor..."



K ← ► N Graph (Spreadsheet) Diagnostics /

Execute a Get Single Attribute call as shown below. Note that the instance value needs to be in hex format (instance 101 is 16#65). The returned value is a 2 byte unsigned integer.

🗱 Class Instance Editor - [Node 192.168.2.101]	×
8	
Execute Transaction Arguments     Code     Object Address	
Value     Description       E     Get Single Attribute         Value     Instance:       Attribute         Value         Class:       Instance:         Attribute:       Image: Attribute instance:         Value         Send the attribute ID	
Transmit data size: Data sent to the device:	
Byte	
Values in decimal	
Receive Data	1
Output size format: Data received from the device: Word (2 bytes)	
Output radix format:	
Close Help	

#### **Creating an Alicat Module**

There are two options for creating the Alicat device module in Logix. One is to create the device as a Generic Ethernet Module. The other is to import the Alicat EDS file and make an Alicat EtherNet/IP Adapter.

#### **Creating a Module from the EDS**

In order to create an Alicat IO device module, you must first import the device EDS file. The EDS is available on the Alicat website at <u>alicat.com/eip</u>.

Once you have the EDS, it can be imported into RSLogix under Tools -> EDS Hardware Installation Tool.

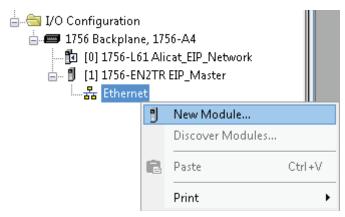
Options	comation's EDS Wizard task do you want to complete?			< A
<b>b</b> °	Register an EDS file(s). This option will add a device(s) to our database.			
<b>(</b>	Unregister a device. This option will remove a device that has been registered by an EDS file from our database.			
<u>R</u>	<sup>1</sup> Create an EDS file. This option creates a new EDS file that allows our software to recognize your device.			
	C Upload EDS file(s) from the device. This option uploads and registers the EDS file(s) stored in the device.			
		< Back	Next >	Cancel

Click Next. Then browse to the location where you saved the EDS file.

Registration Electronic Data Sheet file(s) will be added	o your system for use in Rockwell Automation applications.	J.
Register a single file		
C Register a directory of EDS files	🗖 Look in subfolders	
Named:		
Z:\Personal Backups\Foose\AlicatEIP\AlicatE	IP_v1_5leds Browse	
• If there is an icon file (ico) with the s then this image will be associated with	sme name as the file(s) you are registering the device.	
	To perform an installation test on the file(s), click Next	

Click Next a few times until the import is completed.

To create an Alicat module, right click on your Ethernet network in the I/O Configuration tree and select "New Module..."



Select the Alicat EtherNet/IP Adapter, and press the "Create" button.

elect Module Type					
Catalog Module Discovery Favori	tes				
alicat		Clear Filter	s		Hide Filters 🕱
	e Category Filters	<u> </u>		odule Type Vendor Fil	ters 🔺
CIP Motion Converter CIP Motion Drive			Allen-Bradley Alicat Scientific,	las	
CIP Motion Drive	evice	되			
Communication					_
Communications Adantor		고리로			
					•
Catalog Number	Description			Vendor	Category
Catalog Number 0496_000C_0002	Description EtherNet/IP(tm) Adapter			Vendor Alicat Scientific,	Category Communications Adapt
0496_000C_0002					Communications Adapt
0496_000C_0002					Communications Adapt
0496_000C_0002					Communications Adapt
0496_000C_0002					Communications Adapt

Name your module and give it the static IP address you assigned to the device.

Type: E	ion   Module Info   Internet Protocol   Port Configuration 3therNet/IP(tm) Adapter licat Scientific, Inc.	Network
_	themetIP_Master	Ethernet Address C Private Network: 192.168.1.
Module Definition Revision: Bectronic Keyin Connections:	1.2	

To change the Input size, click the "Change" button under Module Definition. In this example, since we are connecting to an MFC, the input size is 26 bytes.

ľ	1odule Definition*			[	×
Re	vision: 1	•	2 🕂		
Ele	ctronic Keying: Compa	tible Mod	ule	•	
Cor	nnections:				
	Name		Size		1
	Readings	Input:	26	SINT	1
	Readings	Output:	4	SINT	
	ОК	Cano	el	Help	

Repeat the above process for each device you wish to connect to.

There is a bug in certain versions of RSLogix which prevents changing the size of the input from the default specified in the EDS file. If this bug affects your software version then you can add the Alicat as a generic Ethernet communications module using the instructions in the next section.

#### **Creating a Generic Ethernet Module**

To create an Ethernet module, right click on your Ethernet network in the I/O Configuration tree in the controller organization window of RSLogix and select "New Module..."

 e, 175 i1 Alio N2TR	cat_EIP_Network	
1	New Module	
	Discover Modules	
ß	Paste	Ctrl+V
	Print	•

Select the Generic Ethernet Module and press the "Create" button.

gener	Clear F	Iters		Hide Filters 🐟
Module Typ	pe Category Filters	<b>v</b>	Module Type Vendor	Filters 🔺
CIP Motion Converter		Allen-Bradley		
CIP Motion Drive		<ul> <li>Alicat Scientif</li> </ul>	ic, Inc.	
CIP Motion Safety Drive D	Device	Cognex Corpo	oration	
<ul> <li>Communication</li> </ul>	=1		er Systems, Inc.	_
Communications Adaptor	<u> </u>	Endman . Hau	nor	
		·		
Catalog Number	Description		Vendor	Category
ETHERNET-BRIDGE	Generic EtherNet/IP CIP Bridge		Allen-Bradley	Communication
ETHERNET-MODULE	Generic Ethernet Module		Allen-Bradley	Communication
-				

Assign the IP, and set up the Input and Output assemblies. The Input size will be the value as determined in section 3.1 above. There is no configuration assembly, but a value is required, so any instance with a size of zero is acceptable. Using SINT as the format will create a controller tag as an array of bytes for the Input and Output data.

New Module						×
Type: ETHERNET-MO Vendor: Allen-Bradley	DULE Generic Etherne	t Module				
Parent: EthernetIP_Mast	er	Connection Par	ameters			
Description:	<u></u>	Input:	Assembly Instance: 101	Size: 26	→ (8-bit)	
Comm Format: Data - SINT	▼	Output:	100	4	(8-bit)	
Address / Host Name	68 . 2 . 101	Configuration: Status Input:			- (8-Dit)	
O Host Name:		Status Output				
Open Module Properties		OK	Can	cel	Help	

Repeat the above for each device you wish to connect to.

#### Formatting I/O Data

After creating your module in RSLogix, Controller Tags will be automatically created with the name <Module>:I and <Module>:O for input and output data respectively. These will both default to arrays of SINT values, but the input and output data are composed of mixed data types.

From your main project window in RSLogix, import the Alicat-EIP-UpdateInput.I5x file:

🏭 R	SLogi	ix 500	0 - LOGI	K5561	[1756-L6	1 20.1	9]*		
File	Edit	View	Search	Logic	Communi	cations	Tools	Window	Help
Ē	<u>N</u> ew.				Ctrl+N	ИГ			
B	<u>O</u> pen				Ctrl+O	Ľ,			
	<u>C</u> lose					11	L_0		Path:
	Save				Ctrl+S	11	U		-116
	Save	<u>A</u> s					۵	ा <u>म</u> ा म	\ Fave
	New	Compor	pent						1
		rt Comp				0		× II Instruction	
	Tubo	rt Comp	onent			-	_		
	Comp	act				- 010	Data Typ		
		0-1				_ °		nt Phase	•
	-	Setup.				~	Program		
	-	rate Re	eport				<u>R</u> outine.		
	<u>P</u> rint				•	· 🙀	<u>S</u> tring Ty	/pe	
	Print	Op <u>t</u> ion:	s				Tre <u>n</u> d		
	<u>1</u> LO0	GIX556	1.ACD						
	<u>2</u> Tes	t_Lab_	MOwen.A	CD					
	<u>3</u> PLC	TEST.A	ACD						
	<u>4</u> Tes	t_Lab./	ACD						
	<u>5</u> Log	ix_556	1_TESTLA	B.ACD					
	<u>6</u> Alic	at_EIP	ACD						
	E <u>x</u> it								

Select Alicat-EIP-UpdateInput.I5x to import the instruction.

🕌 Import Add-0	n Instruction				×
Look in:	AlicatEIP		💽 🌀 💋	Þ 📂 🖽 -	
Look II:	AlcatEIP	lateInput.L5X	▼ Date n 8/6/20 5/31/2		Type Logix Designer XML File Logix Designer XML File Logix Designer XML File
Network	✓ File name: Files of type: Files containing: Files containing: Into:	Alicat-EIP-UpdateInput RSLogix 5000 XML Files (*1.1 @ Add-On Instruction @ Add-On Instructions	.5X)	2	Import Cancel Help

After importing, there will now be an AOI called AlicatUpdateInput, a UDT called AlicatIoData, and an Add-On-Defined data type located in the controller organization window.

The UDT has the following format.

AlicatloData 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 of Selected Gas		
Config	SINT	Validity Flags of Device		

The device status flags have a bit overlay which decodes the individual bit flags.

AlicatloData UDT Status Overlay				
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	Volumetric Overflow		
Status[5] – M_UNDER	BOOL	Volumetric Underflow		
Status[6] – P_OVER	BOOL	Pressure Overflow		
Status[7] – TOT_OVER	BOOL	Totalizer Overflow		
Status[8] – HLD	BOOL	PID Loop in Hold		
Status[9] – ADC	BOOL	ADC Error		
Status[10] – EXH	BOOL	PID Exhaust		
Status[11] – OPL	BOOL	Over Pressure Limit		
Status[12] – TMF	BOOL	Flow Overflow During Totalizer		

The Config flag is a bit overlay used to tell the Add-On Instruction which readings are present in the device. This value can be written using a one-time MOV operation in your ladder logic and allows easy setting/decoding of the config value.

AlicatloData UDT Config Overlay				
Name Type		Description		
Config[0] – PRESS	BOOL	Pressure Reading Valid		
Config[1] – TEMP	BOOL	Temperature Reading Valid		
Config[2] – VFLOW	BOOL	Volumetric Flow Reading Valid		
Config[3] – MFLOW	BOOL	Mass Flow Reading Valid		
Config[4] – SP	BOOL	Setpoint Reading Valid		
Config[5] – VDRIVE	BOOL	Valve Drive Percentage Reading Valid		
Config[6] – TOTAL	BOOL	Totalizer Reading Valid		

The Config flag is stored as hexadecimal number, but an MOV command will accept binary arguments and convert the type automatically if you find this more intuitive than calculating a hex value. A binary value can be specified by prefacing the number with 2#.

The following table shows example Config flag settings based on device type. Binary values are shown in parenthes.

AlicatloData Config Flag				
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		

If the incorrect bit mask is set, then device variables will be assigned to the incorrect position in the array (temperature being stored as flow, for example).

In order to use the AOI, create a tag with the AlicatloData data type for each device you wish to use. You also need a tag of the type AlicatUpdateInput, which is used by the AlicatUpdateInput AOI. Since IO data is updated asynchronously in a ControlLogix PLC, it is also good idea to create an array of type SINT to buffer the input data before passing it to the AOI.

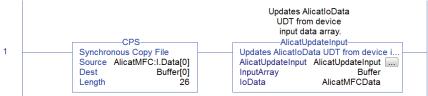
A single buffer can be used for multiple devices, as long as it is as big as the largest input size. If the buffer is too small, then the I/O data from the device will be truncated.

Name	Alias For	Base Tag	Data Type
			AlicatloData
			AlicatUpdateInput
+ Buffer			SINT[26]

The following ladder logic uses these instructions to configure and read IO data from the devices.

	S:FS	MOV	7
0	] [	Move Source 16#1F	
		Dest AlicatMFCData.Config 16#00∢	

**Rung 0.** First, the XIC element tied to the special S:FS (set first scan) bit is evaluated. This bit is set automatically to 1 on the first scan of the ladder logic only, so this rung is used to set initial configuration. The MOV element sets the configuration bitmask of the IO tags AlicatMFCData by copying either hexadecimal or binary numbers to the appropriate array element. The number used will change depending on the type of device you are configuring:



**Rung 1.** A CPS element copies the unformatted IO data from the input assembly modulename:I:Data[0] to a buffer array. CPS should be used instead of COP when dealing directly with device I/O to prevent corrupted data from being copied when the instruction runs in the middle of an I/O memory scan.

Then the AlicatUpdateInput instruction runs, copying this buffer data into the IOdata tag and appropriately formatting it.

Once this code is downloaded to the PLC and the PLC is switched to run mode, you should see well-formatted I/O data populated in the "Monitor Tags" window of the tag manager.

# **Changing the Setpoint**

Changing the setpoint of your Alicat is accomplished by copying a 4 byte floating point (real) number to the device's output. The AlicatlOData data type includes read/ write REAL type element for storing the desired setpoint. A copy instruction from this element directly into the output tag allows setpoint control by directly editing this element.

3

COP	
Copy File Source AlicatMFCData.RequestedSetpoint Dest AlicatMFC:O Length 4	

In this example of ladder logic, a CPS instruction copies this data directly to the output of an MFC, updating the setpoint every scan. An external interface or other code can then be used to edit the AlicatMFC.RequestedSetpoint value, or the value can be edited directly from the "Monitor Tags" tab of the tag manager window to test your code.

#### **Sending a Command**

As described in section 1.4 above, asynchronous commands can be sent to the Alicat device with explicit CIP messages to assemblies 102 through 104. To make this easier, we have provided an add-on instruction set with logic that sends well-formed commands to instance 102 and automatically reads the command result from instance 103.

To use this AOI, import the Alicat-EIP-Command.I5x Add-On Instruction, available on the Alicat website. This instruction requires four controller tags to operate:

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

Name	Alias For	Base Tag	Data Type
+-AlicatRequestMsg			MESSAGE
AlicatResponseMsg			MESSAGE
+-AlicatCmdData			INT[2]
+-AlicatCmd			AlicatCommand
CmdTrigger			BOOL

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

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

Configure the MESSAGE tags as follows by right clicking on the tag name and selecting "Configure".

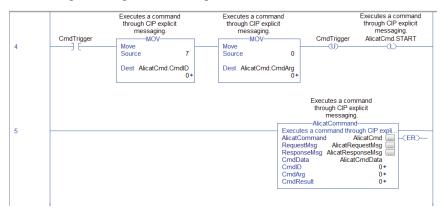
Message Type:       CIP Generic         Service       Set Attribute Single       Source Element:         Type:       Source Length:         Service       10         Instance:       102         Attribute:       (Hex)         Class:       4         (Hex)       Destination         Element:       New Tag	Message Configuration - AlicatRequestMsg Configuration Communication Tag	
○ Error Code: Extended Error Code:	Service Set Attribute Single	Source Length: 4 (Bytes) Destination Element:
Error Text: OK Cancel Apply Help	Error Code: Extended Error Code: Error Path: Error Text:	Timed Out +

Message Configuration - AlicatResponseMsg	X
Configuration Communication Tag	
Message Type: CIP Generic	
Service Get Attribute Single	Source Element:
	Source Length: 0 📻 (Bytes)
Service e (Hex) Class: 4 (Hex)	Destination AlicatCmdData 👻
Instance: 103 Attribute: 3 (Hex)	Element: New Tag
○ Enable ○ Enable Waiting ○ Start	O Done Done Length: 0
Error Code: Extended Error Code: Error Path: Error Text:	☐ Timed Out ←
ОК	Cancel Apply Help

On the Communication tab set the path to the device you wish to communicate with, ensuring it is the same for both messages.

Message Configuration - AlicatRequestMsg
Configuration Communication Tag
Path: AlicatMFC Browse
AlicatMFC
C Broadcast:
Communication Method         Image: CIP Image: CIP With Source Link:         Image: CIP With Source Link:         Image: CIP With Source Link:
Source ID Source Emit: B Source ID
Connected Cache Connections + Large Connection
⊖ Enable ⊖ Enable Waiting ⊖ Start ⊖ Done Done Length: 0
○ Error Code: Extended Error Code:
Error Path: Error Text:
OK Cancel Apply Help

The following ladder logic uses these tags to send a command:



**Rung 4** starts with an XIC element tied to the CmdTrigger as a switch to trigger the command. Next, two MOV elements store the desired command ID and command argument in the appropriate AlicatCmd tag element to prepare the command. In this example, the gas select command (ID 1) with argument 1 (Gas Index) is prepared. Then the OTU element resets the CmdTrigger, so the command only runs once. Finally, an OTL element sets the Boolean AlicatCmd.START element to 1.

**Rung 5** contains only the AlicatCommand element. This add-on instruction is evaluated every scan to see if the AlicatCmd.START element is set to 1. If it is set to 1, the AlicatCmd.CmdID and CmdArg elements are stored in the AlicatCmdData buffer, then passed to the Request message tag to send the command. Then, instance 103 is read by the Response message tag, and the result is copied back to the command buffer. Finally, the AlicatCmd.START bit is unlatched. If any error codes are returned to the command buffer, the ER bit will be tripped.

Note that after setting AlicatCMD.START, it should not be set again until the command finishes (indicated by the AlicatCMD.EnableOut bit going high), or unpredictable results may occur.

If you would like additional information regarding the use of this product, please contact:

Alicat Scientific, Inc. 7641 N Business Park Drive Tucson, Arizona 85743 USA Phone: 520-290-6060 Fax: 520-290-0109 Email: info@alicat.com Website: www.alicat.com