Programming Manual

Allen-Bradley

Logix 5000 Controllers ASCII Strings

1756 ControlLogix, 1756 GuardLogix, 1769 CompactLogix,
1769 Compact GuardLogix, 1789 SoftLogix, 5069 CompactLogix,
5069 Compact GuardLogix, Studio 5000 Logix Emulate

Allen-Bradley • Rockwell Software

Rockwell Automation

Important user information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice. If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
Important:	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

This manual includes new and updated information. Use these reference tables to locate changed information.

Grammatical and editorial style changes are not included in this summary.

Global changes

This table identifies changes that apply to all information about a subject in the manual and the reason for the change. For example, the addition of new supported hardware, a software design change, or additional reference material would result in changes to all of the topics that deal with that subject.

Subject	Reason
Updated Logix Designer application screen shots.	The Studio 5000 Logix Designer® interface has been modified in versions 31 and later.
Updated supported controller models.	Added 5069 CompactGuardLogix to the list of supported controllers.

New or enhanced features

None in this release.

Table of contents

This manual shows how to manipulate ASCII strings in Logix 5000 controllers. This manual is one of a set of related manuals that show common procedures for programming and operating Logix 5000™ controllers.

For a complete list of common procedures manuals, refer to the Logix 5000 Controllers Common Procedures Programming Manual , publication 1756-PM001 .

- The term Logix 5000 controller refers to any controller that is based on the Logix 5000 operating system.

Studio 5000 environment

The Studio 5000 Automation Engineering & Design Environment® combines engineering and design elements into a common environment. The first element is the Studio 5000 Logix Designer® application. The Logix Designer application is the rebranding of RSLogix 5000® software and will continue to be the product to program Logix 5000™ controllers for discrete, process, batch, motion, safety, and drive-based solutions.

The Studio 5000® environment is the foundation for the future of Rockwell Automation® engineering design tools and capabilities. The Studio 5000 environment is the one place for design engineers to develop all elements of their control system.

Additional resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines , publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications webpage, available at http://ab.rockwellautomation.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature . To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

Legal notices

Copyright notice

End User License Agreement (EULA)

You can view the Rockwell Automation End-User License Agreement ("EULA") by opening the License.rtf file located in your product's install folder on your hard drive.

Other Licenses

The software included in this product contains copyrighted software that is licensed under one or more open source licenses. Copies of those licenses are included with the software. Corresponding Source code for open source packages included in this product can be located at their respective web site(s).

You may alternately obtain complete Corresponding Source code by contacting Rockwell Automation via our Contact form on the Rockwell Automation website: http://www.rockwellautomation.com/global/about-us/contact/contact.page .
Please include "Open Source" as part of the request text.

The following open source software is used in this product:

Software	Copyright	License Name	License Text
AngularJS	Copyright 2010-2017 Google, Inc.	MIT License	AngularJS 1.5.9 License
Bootstrap	Copyright 2011-2017 Twitter, Inc. Copyright 2011-2017 The Bootstrap Authors	MIT License	Bootstrap 3.3.7 License
jQuery	Copyright 2005, 2014 JS Foundation and other contributors	MIT License	jQuery 2.1.1 License
OpenSans	Copyright 2017 Google, Inc.	Apache License, Version 2.0	OpenSans License

Trademark Notices

Allen-Bradley, ControlBus, ControlFLASH, Compact GuardLogix, Compact I/O, ControlLogix, CompactLogix, DCM, DH+, Data Highway Plus, DriveLogix, DPI, DriveTools, Explorer, FactoryTalk, FactoryTalk Administration Console, FactoryTalk Alarms and Events, FactoryTalk Batch, FactoryTalk Directory, FactoryTalk Security, FactoryTalk Services Platform, FactoryTalk View, FactoryTalk View SE, FLEX Ex, FlexLogix, FLEX I/O, Guard I/O, High Performance Drive, Integrated Architecture, Kinetix, Logix5000, Logix 5000, Logix5550, MicroLogix, DeviceNet, EtherNet/IP, PLC-2, PLC-3, PLC-5, PanelBuilder, PowerFlex, PhaseManager, POINT I/O, PowerFlex, Rockwell Automation, RSBizWare, Rockwell Software, RSEmulate, Historian, RSFieldbus, RSLinx, RSLogix, RSNetWorx for DeviceNet, RSNetWorx for EtherNet/IP, RSMACC, RSView, RSView32, Rockwell Software Studio 5000 Automation Engineering & Design Environment, Studio 5000 View Designer, SCANport, SLC, SoftLogix, SMC Flex, Studio 5000, Ultra 100, Ultra 200, VersaView, WINtelligent, XM, SequenceManager are trademarks of Rockwell Automation, Inc.

Any Rockwell Automation logo, software or hardware product not mentioned herein is also a trademark, registered or otherwise, of Rockwell Automation, Inc.

Other Trademarks

CmFAS Assistant, CmDongle, CodeMeter, CodeMeter Control Center, and WIBU are trademarks of WIBU-SYSTEMS AG in the United States and/or other countries. Microsoft is a registered trademark of Microsoft Corporation in the United States and/or other countries. ControlNet is a trademark of ControlNet International. DeviceNet is a trademark of the Open DeviceNet Vendors Association (ODVA). Ethernet/IP is a trademark of ControlNet International under license by ODVA.

All other trademarks are the property of their respective holders and are hereby acknowledged.

Warranty

This product is warranted in accordance with the product license. The product's performance may be affected by system configuration, the application being performed, operator control, maintenance, and other related factors. Rockwell Automation is not responsible for these intervening factors. The instructions in this document do not cover all the details or variations in the equipment, procedure, or process described, nor do they provide directions for meeting every possible contingency during installation, operation, or maintenance. This product's implementation may vary among users.

This document is current as of the time of release of the product; however, the accompanying software may have changed since the release. Rockwell Automation, Inc. reserves the right to change any information contained in this document or the software at any time without prior notice. It is your responsibility to obtain the most current information available from Rockwell when installing or using this product.

Environmental compliance

Rockwell Automation maintains current product environmental information on its website at
http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page

Contact Rockwell Automation

Customer Support Telephone — 1.440.646.3434

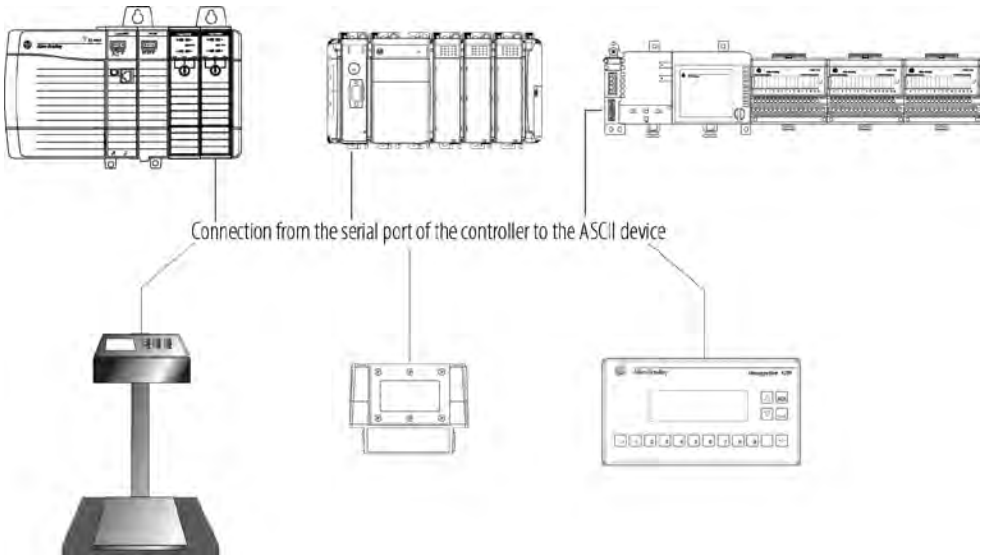
Online Support — http://www.rockwellautomation.com/support/

Communicating with an ASCII device

Introduction

You can exchange ASCII data with a device through the serial port of the controller. For example, you can use the serial port to:

- Read ASCII characters from a weigh scale module or bar code reader.
- Send and receive messages from an ASCII triggered device, such as a MessageView terminal.

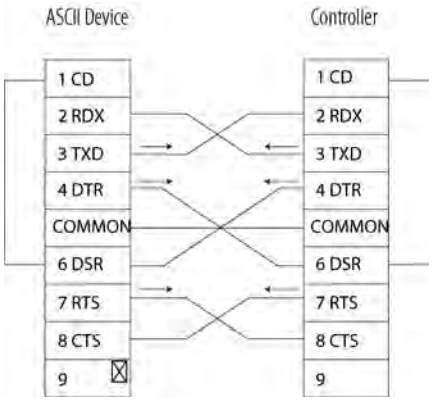
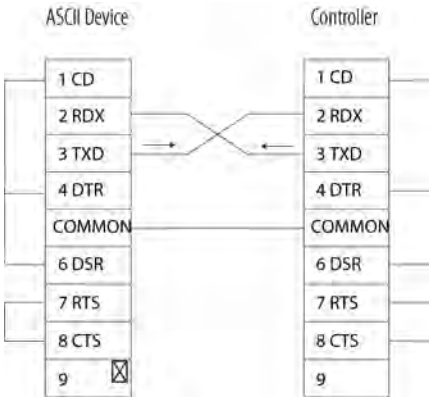


Firmware revision 3.1 and later of the 1756-EWEB EtherNet/IP Web Server module supports the controller serial port and a socket interface that lets Logix 5000 controllers exchange ASCII data using TCP or UDP socket services.

Connect the ASCII device

To connect to the ASCII device, use these steps.

1. On the serial port of the ASCII device, determine which pins send signals and which pins receive signals.
2. Connect sending pins to corresponding receiving pins and attach jumpers.

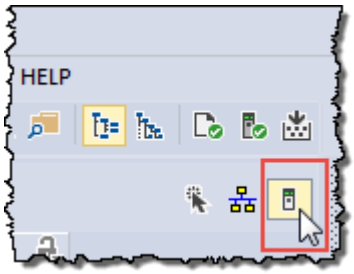
If the communications	Then wire the connectors
Handshake	
Do not handshake	

3. Attach the cable shield to the connectors.
4. Connect the cable to the controller and the ASCII device.

Configure the Serial Port

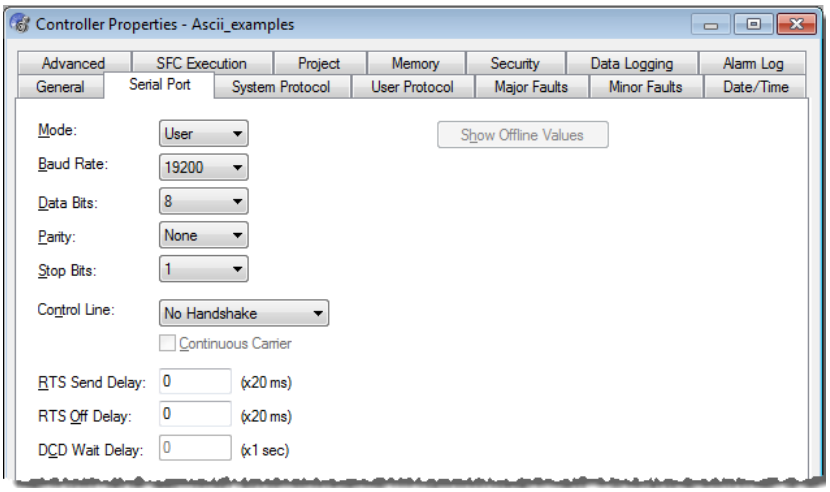
To configure the serial port, use these steps.

1. On the **Online** toolbar, click the **Controller Properties** button.



2. On the **Controller Properties** dialog box, click the **Serial Port** tab.

3. On the **Mode** menu, choose **User** and type the configuration settings for the serial port.



- choose the baud rate, data bits, parity, and stop bits.
- in the **Control Line** menu, choose the **Control Line** option:

If	And	And this is the	Choose	Then
You are **not** using a modem	---------->		No Handshaking	
You are using a modem	Modems in a point-to-point link are full-duplex	---------->	Full Duplex	
	Master modem is full-duplex while slave modem is half-duplex	master controller.	Full Duplex	
		slave controller	Half Duplex	Select the **Continuous Carrier** check box.
	All modems in the system are half-duplex	---------->	Half Duplex	Clear the **Continuous Carrier** check box (default).

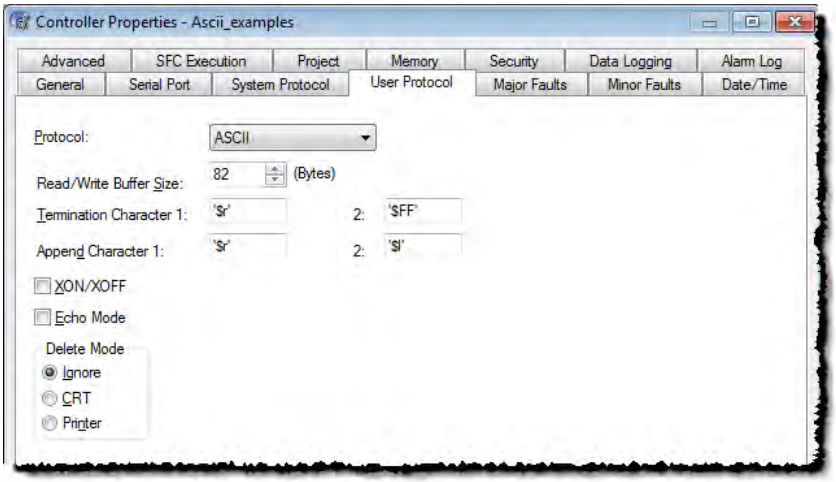
- in the **RTS Send Delay** box, type the delay (in 20 ms units) between the time the RTS signal turns on (high) and the time that data is sent. For example, a value of 4 produces an 80 ms delay.
- in the **RTS Off Delay** box, type the delay (in 20 ms units) between the time the last character is sent and the time that the RTS signal turns off (low).

4. Click **Apply.**

Configure the User Protocol

To configure the user protocol, use these steps.

1. In the **Controller Properties** dialog box, click the **User Protocol** tab.



- Enter a buffer size greater than or equal to the greatest number of characters in a transmission. Twice the number of characters is a good guideline.
- For ABL or ARL instructions, enter termination characters to mark the end of the data. For ASCII codes, see ASCII Character Codes on page 31.

If the device sends	Then	Tips
One termination character	• In the **Termination Character 1** box, type the hexadecimal ASCII code for the first character. • In the **Termination Character 2** box, type $FF.	For printable characters, such as 1 or A, type the character.
Two termination characters	In the **Termination Character 1** and **2** boxes, type the hexadecimal ASCII code for each character.	

- For AWA instruction, enter append characters. For ASCII codes, see ASCII Character Codes on page 31.

To append	Then	Tips
One character	• In the **Append Character 1** box, type the hexadecimal ASCII code for the first character. • In the **Append Character 2** box, type $FF.	For printable characters, such as 1 or A, type the character.
Two characters	In the **Append Character 1** and **2** boxes, type the hexadecimal ASCII code for each character.	

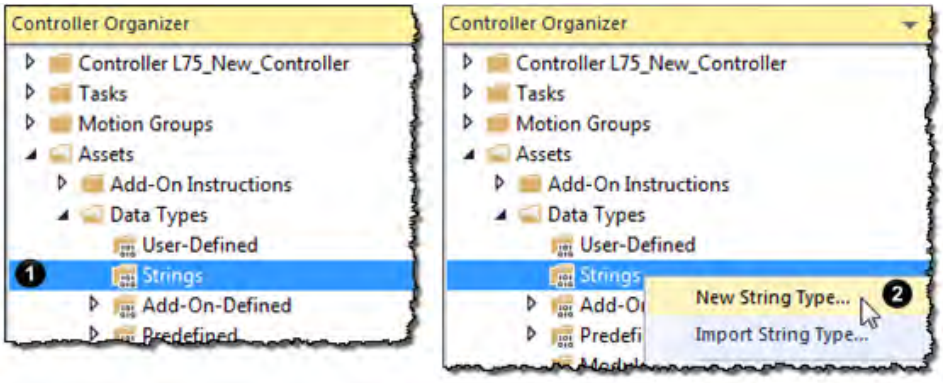
- If the ASCII device is configured for XON/XOFF flow control, select the **XON/XOFF** check box.
- If the ASCII device is a CRT or pre-configured for half duplex transmission, select the **Echo Mode** check box.
- Choose the **Delete Mode** using the following considerations:

If the ASCII device is	Select	Tips
CRT	CRT	• The DEL character ($7F) and the character that precedes the DEL character are **not** sent to the destination. • If echo mode is selected and an ASCII instruction reads the DEL character, the echo returns three characters: BACKSPACE SPACE BACKSPACE ($08 $20 $08).
Printer	Printer	• The DEL character ($7F) and the character that precedes the DEL character are **not** sent to the destination. • If echo mode is selected and an ASCII instruction reads the DEL character, the echo returns two characters: / ($2F) followed by the character that was deleted.
None of the above	Ignore	The DEL character ($7F) is treated as any other character.

2. Click **OK**.

Create string data types

Store ASCII characters in tags that use a string data type.



1 You can use the default STRING data type. It stores up to 82 characters.

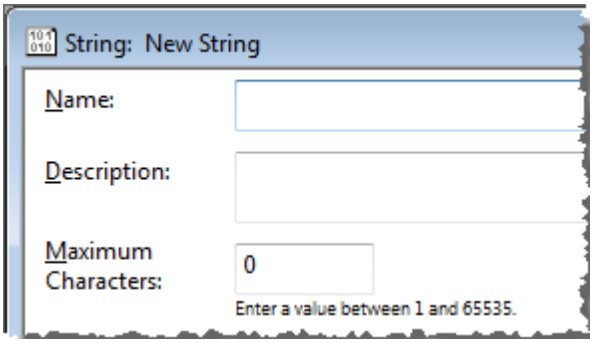
or

2 You can create a string data type to store the number of characters that you define.

Important: Use caution when you create a string data type. If you decide later to change the size of the string data type, you may lose data in any tags that currently use that data type.

If you	Then
Make a string data type smaller	• The data truncates. • The LEN does not change.
Make a string data type larger	The data and LEN resets to zero.

1. In the Controller Organizer, right-click **Strings** and choose **New String Type**.



2. In the **Name** box, type the name for the data type.
3. In the **Maximum Characters** box, enter the maximum number of characters that the string data type stores.
4. Click **OK**.

Read characters from the device

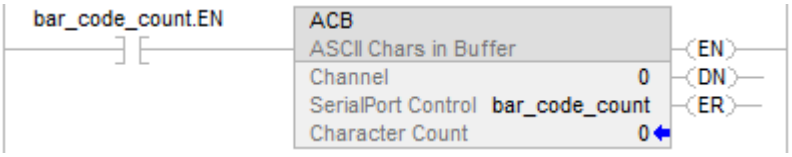
As a general rule, before you read the buffer, use an ACB or ABL instruction to verify that the buffer contains the required characters.

- An ARD or ARL instruction continues to read the buffer until the instruction reads the required characters.
- While an ARD or ARL instruction reads the buffer, no other ASCII Serial Port instructions, except the ACL, can execute.
- Verifying that the buffer contains the required characters prevents the ARD or ARL from holding up the execution of other ASCII Serial Port instructions while the input device sends its data.

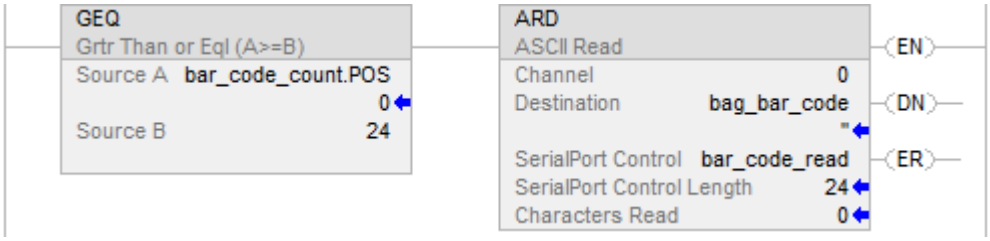
For additional information on ASCII Serial Port instructions, see *Logix 5000 Controllers General Instruction Set Reference Manual http://literature.rockwellautomation.com/idc/groups/literature/documents/rm/1756-rm003_-en-p.pdf*.

In the following example, the device sends a fixed number of characters, such as a bar code reader:

Example: A bar code reader sends bar codes to the serial port (channel 0) of the controller. Each bar code contains 24 characters. To determine when the controller receives a bar code, the ACB instruction continuously counts the characters in the buffer.



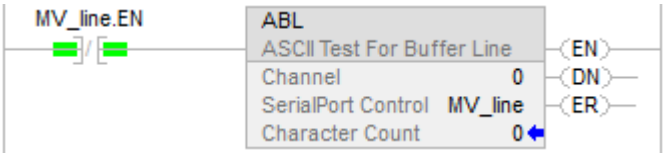
When the buffer contains at least 24 characters, the controller received a bar code. The ARD instruction moves the bar code to the bag_bar_code tag.



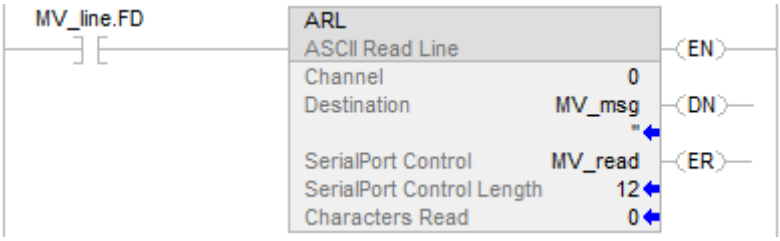
In the following example, the device sends a variable number of characters, such as a message or display terminal.

Example: Continuously test the buffer for a message.

- Because each message ends in a carriage return ($0D), the carriage return is configured as the termination character in the Controller Properties dialog box, User Protocol tab.
- When the ABL finds a carriage return, its sets the FD bit.



When the ABL instruction finds the carriage return (MV_line.FD is set), the controller removes the characters from the buffer, up to and including the carriage return, and places them in the MV_msg tag.



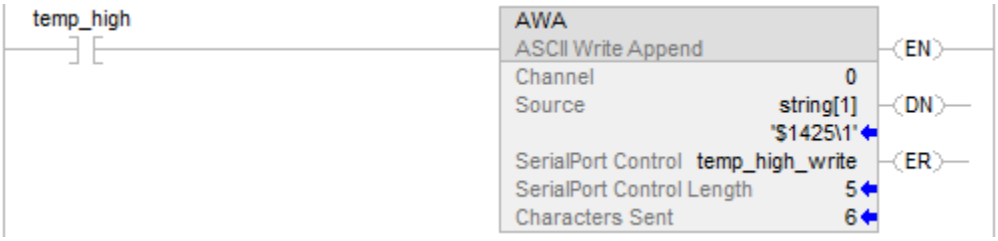
Send characters to the device

When you send characters to the device, you must determine either to send the same number of characters each time or to append terminations characters to the data.

In the following example, you always send the same number of characters and want to automatically append one or two characters to the end of the data.

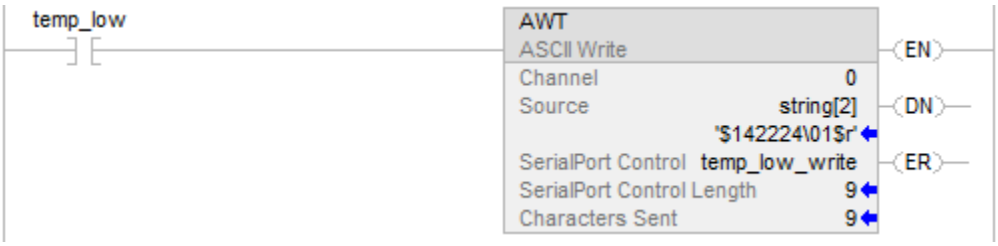
Example: When the temperature exceeds the high limit (temp_high is on), the AWA instruction sends five characters from the string[1] tag to a MessageView terminal.

- The $14 counts as one character. The hex code for the Ctrl-T character.
- The instruction also sends (appends) the characters defined in the user protocol. In this example, the AWA instruction sends a carriage return ($0D), which marks the end of the message.



And then to always send the same number of characters:

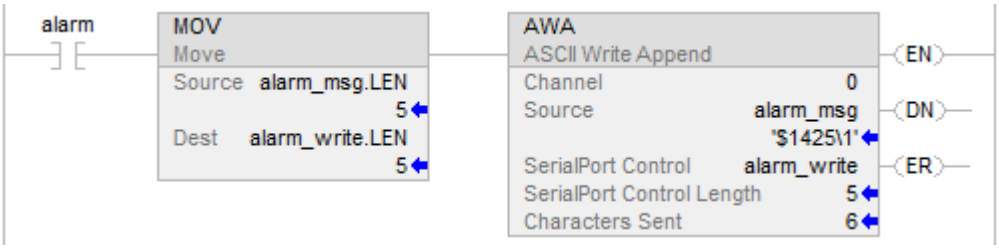
Example: When the temperature reaches the low limit (temp_low is on), the AWT instruction sends nine characters from the string[2] tag to a MessageView terminal. (The $14 counts as one character. The hex code for the Ctrl-T character.)



In the following example, you send a different number of characters each time and want to automatically append one or two characters to the end of the data:

Example: When alarm is on, the AWA instruction sends the characters in alarm_msg and appends a termination character.

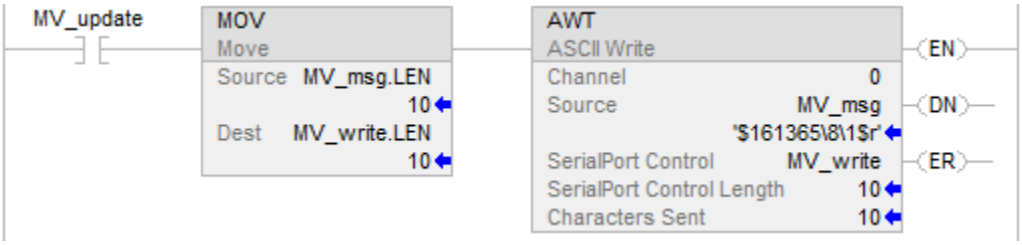
- Because the number of characters in alarm_msg varies, the rung first moves the length of alarm_msg (alarm_msg.LEN) to the length of the AWA instruction (alarm_write.LEN).
- In alarm_msg, the $14 counts as one character. The hex code for the Ctrl-T character.



Send a different number of characters each time:

Example: When MV_update is on, the AWT instruction sends the characters in MV_msg.

- Because the number of characters in MV_msg varies, the rung first moves the length of MV_msg (MV_msg.LEN) to the length of the AWT instruction (MV_write.LEN).
- In MV_msg, the $16 counts as one character. The hex code for the Ctrl-V character.

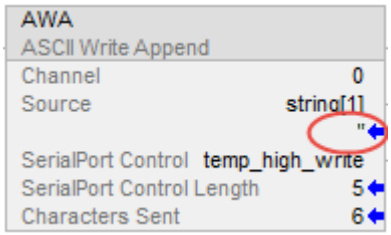


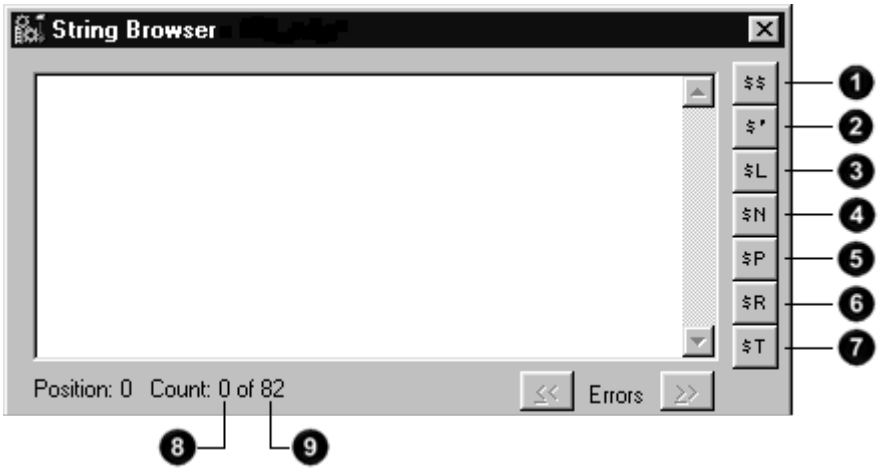
Enter ASCII characters

To enter the ASCII characters, use these steps.

Important:	This String Browser window shows the characters up to the value of the LEN member of the string tag. The string tag may contain additional data, which the String Browser window does not show.

1. In the **AWA** instruction, double-click the value area of **Source**.





1	Dollar sign ($24)	6	Carriage return ($0D)
2	Single quote ($27)	7	Tab ($09)
3	Line feed ($0A)	8	The number of characters that you see in the window. The same as the LEN member of the string tag.
4	New line ($0D$0A)	9	The maximum number of characters that the string tag can hold.
5	Form feed ($0C)		

2. In the text box, type the characters for the string.
3. Click **OK.**

Processing ASCII characters

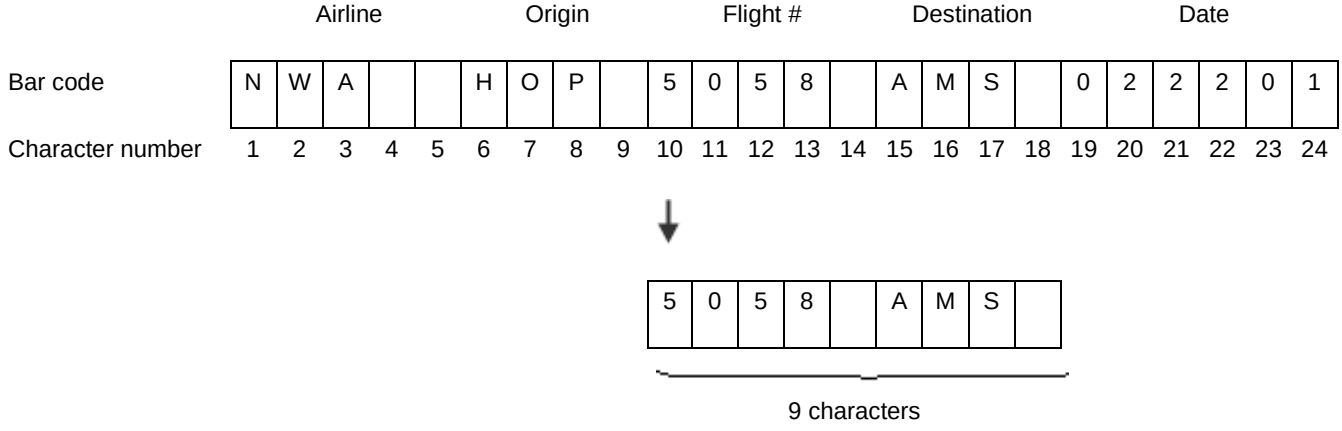
Introduction

You can process ASCII characters to do many things, including:

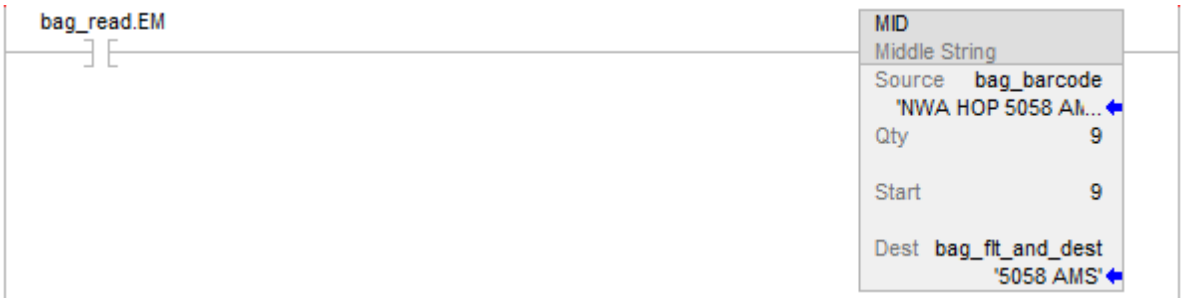
- Interpret a bar code and take action based on the bar code.
- Use a weight from a weigh scale when the weight is sent as ASCII characters.
- Decode a message from an ASCII triggered device, such as an operator terminal.
- Build a string for an ASCII triggered device using variables from your application.

Extract a part of a Bar Code

For example, a bar code may contain information about a bag on a conveyor at an airport. To check the flight number and destination of the bag, you extract characters 10 - 18.

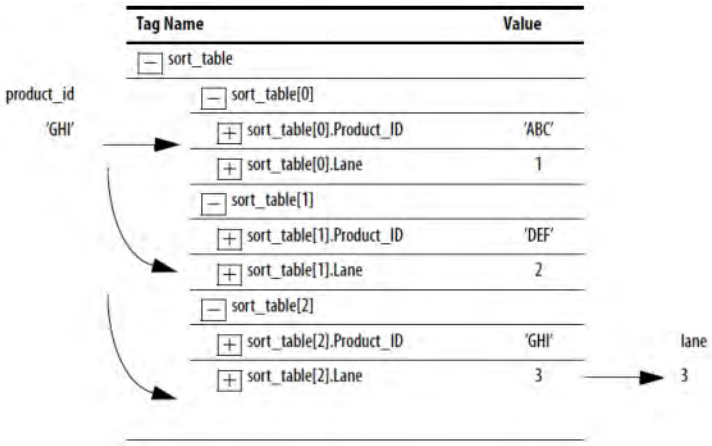


Example: In the baggage handling conveyor of an airport, each bag gets a bar code. Characters 10 - 18 of the bar code are the flight number and destination airport of the bag. After the bar code is read (bag_read.EM is on) the MID instruction copies the flight number and destination airport to the bag_flt_and_dest tag.



Look up a Bar Code

For example, in a sorting operation, an array of a user-defined data type creates a table that shows the lane number for each type of product. To determine which lane to route a product, the controller searches the table for the product ID (characters of the bar code that identify the product).



To look up a bar code, follow these procedures:

- Create the PRODUCT_INFO Data Type on page 23.
- Search for the Characters on page 23.
- Identify the Lane Number on page 24.
- Reject Bad Characters on page 24.
- Enter the Product IDs and Lane Numbers on page 25.

Tip: To copy the above components from a sample project, open the **Samples** folder. On the **Help** menu, click **Vendor Sample Projects**.

Create the PRODUCT_INFO Data Type

To create a Product_Info user-defined date type in the Controller Organizer, right-click **User-Defined** and click **New Data Type**. Configure the user-defined data type as follows.

Data Type: PRODUCT_INFO				
Name	PRODUCT_INFO			
Description	Identifies the destination for an item based on an ASCII string of characters that identify the item			
Members				
Name		**Data Type**	**Style**	**Description**
⊞	Product_ID	STRING		ASCII characters that identify the item
	Lane	DINT	Decimal	Destination for the item, based on its ID

Search for the characters

You can search for characters by creating the following ladder logic routine.

The SIZE instruction performs the following:

- Counts the number of elements in the sort_table array (type PRODUCT_INFO). This array contains the product ID for each item and the corresponding lane number for the item.
- Counts the number of elements in Dimension 0 of the array. In this case, the only dimension.
- Sets the Length of the subsequent FSC instruction equal to the size of the sort_table array.

The FSC instruction searches each Product_ID member in the sort_table array until the instruction finds a match to the product_id tag.

- The sort_table_search tag controls the FSC instruction.

- Although the previous instruction sets the Length of this instruction, you enter an initial value to verify the project.
- The product_id tag contains the bar code characters that you want to find.

Identify the Lane Number

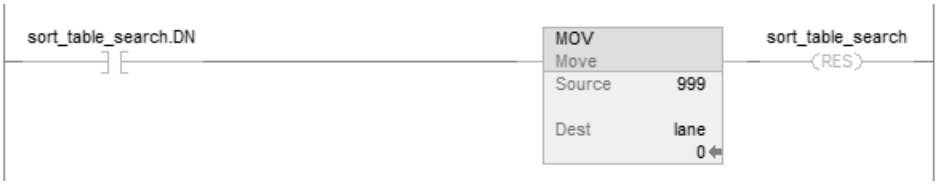
Add the following rung to the routine to identify the LANE member.

When the FSC instruction finds the product ID within the sort_table array, the instruction sets the FD bit. The POS member indicates the element number within the sort_table array of the match. The corresponding LANE member indicates the lane number of the match.

Based on the POS value, the MOV instruction moves the corresponding lane number into the lane tag. The controller uses the value of this tag to route the item.

After the MOV instruction sets the value of the lane tag, the RES instruction resets the FSC instruction so it can search for the next product ID.

Reject bad characters



If the FSC instruction does not find the product ID within the sort_table array, the instruction sets the DN bit. The MOV instruction moves 999 into the lane tag to notify the controller to reject or reroute the item.

After the MOV instruction sets the value of the lane tag, the RES instruction resets the FSC instruction so it can search for the next product ID.

Enter the Product IDs and Lane Numbers

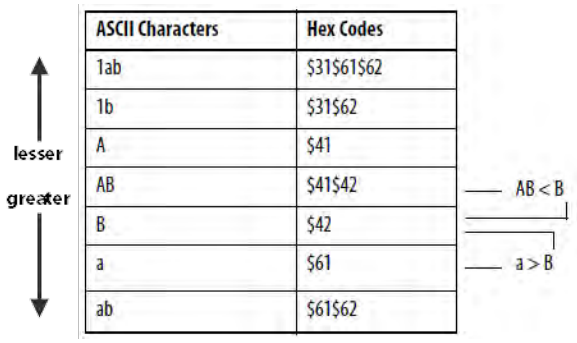
In the sort_table array, enter the ASCII characters to identify each item and the corresponding lane number for the item.

Tag Name	Value
◢ sort_table	{...}
◢ sort_table[0]	{...}
▷ sort_table[0].Product_ID	ASCII characters that identify the first item
▷ sort_table[0].Lane	Lane number for the item
◢ sort_table[1]	{...}
▷ sort_table[1].Product_ID	ASCII characters that identify the next item
▷ sort_table[1].Lane	Lane number for the item

Check the Bar Code characters

Use a compare instruction (EQU, GEQ, GRT, LEQ, LES, NEQ) to check for characters.

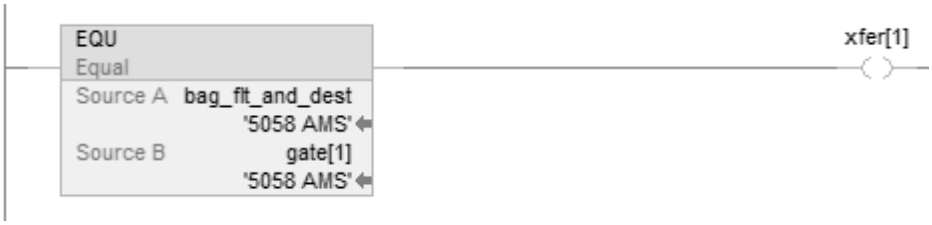
- The hexadecimal values of the characters determine if one string is less than or greater than another string.
- When the two strings are sorted, as in a telephone directory, the order of the strings determines which one is greater.



Use one of the following compare instruction.

To see if the string is:	Enter this instruction:
Equal to specific characters	EQU
Not equal to specific characters	NEQ
Greater than specific characters	GRT
Equal to or greater than specific characters	GEQ
Less than specific characters	LES
Equal to or less than specific characters	LEQ

Example: When bag_flt_and_dest is equal to gate[1], xfer[1] turns on. This routes the bag to the required gate.



Convert a value

You can convert the ASCII representation of a value to an DINT or REAL value that you can use in your application.

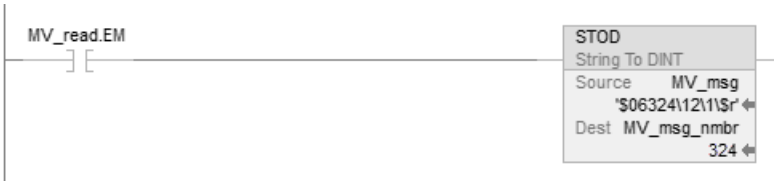
- The STOD and STOR instructions skip any initial control or non-numeric characters (except the minus sign in front of a number).
- If the string contains multiple groups of numbers that are separated by delimiters (for example, /), the STOD and STOR instructions convert only the first group of numbers.

The following rung converts ASCII characters to a floating-point value:

Example: After reading the weight from the scale (weight_read.EM is on), the STOR instruction converts the numeric characters in weight_ascii to a REAL value and stores the result in weight.

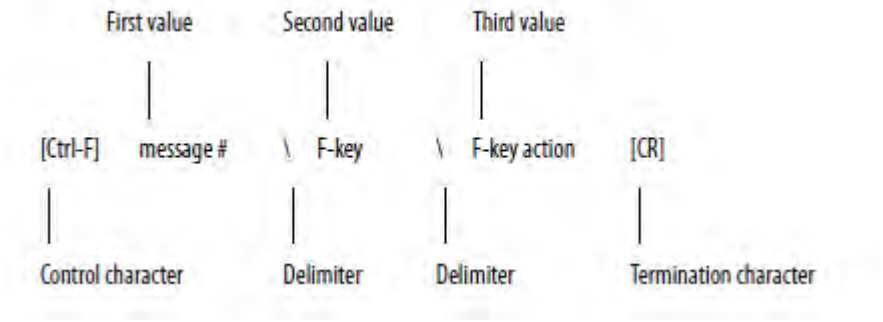
The following rung converts ASCII characters to an integer value:

Example: When MV_read.EM is on, the STOD instruction converts the first set of numeric characters in MV_msg to an integer value. The instruction skips the initial control character ($06) and stops at the delimiter (\ ).



Decode an ASCII message

You can extract and convert a value from an ASCII message that contains multiple values. A message may look like the following example:



Rung A: Find and Convert a Floating-Point Value

The FIND instruction locates characters within a string.

- The Source contains the string tag to search.
- The Result contains the location where the FIND instruction locates the search value you specify.

The MID instruction identifies a group of characters within a string and places them in their own string tag.

- The source is the same string tag as for the FIND instruction.
- The quantity values tells the MID instruction how many characters to pull from the source.

- The start value is the same as the Result value from the FIND instruction. This tells the MID instruction where to start pulling characters from the Source.
- The Destination contains the characters you located.

Build a string

The following example builds a string that contains two variables. For example, an operator terminal may require a string that looks like the following:

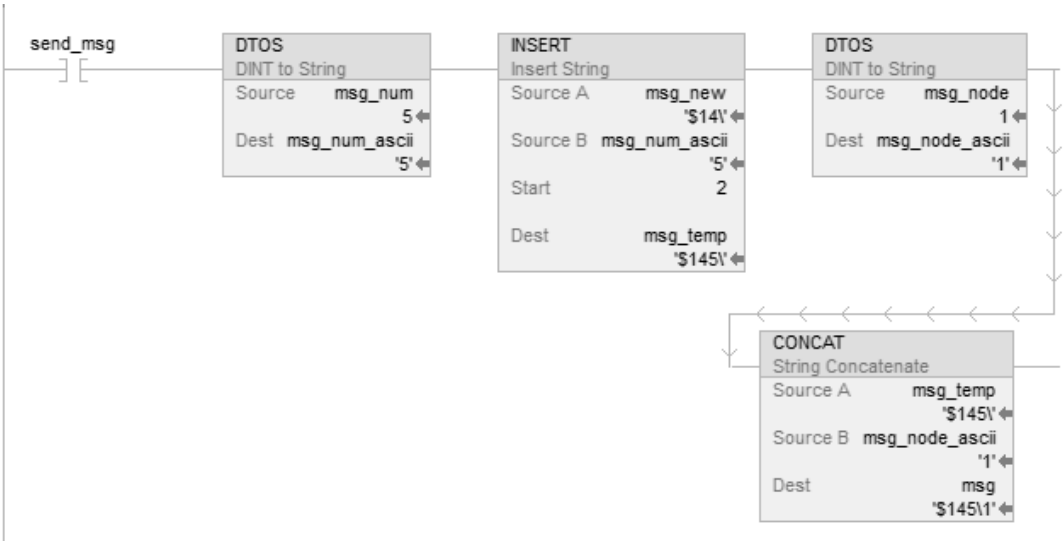
- For more variables, use additional INSERT or CONCAT instructions.
- If you must send a floating-point value, use a RTOS instruction in place of the DTOS instruction.
- The final string excludes the termination character. When you send the string, use an AWA instruction to automatically append the termination character.

Example: To trigger a message in a MessageView terminal, the controller sends the terminal a message in this format: [Ctrl-T] message # \ address [CR]

Important: When send_msg is on, the rung does the following:

- The first DTOS instruction converts the message number to ASCII characters.
- The INSERT instruction inserts the message number (in ASCII) after the control character [Ctrl-T]. (The hex code for Ctrl-T is $14.)
- The second DTOS instruction converts the node number of the terminal to ASCII characters.
- The CONCAT instruction puts the node number (in ASCII) after the backslash [\ ] and stores the final string in msg.

Important:	To send the message, an AWA instruction sends the msg tag and appends the carriage return [CR].



ASCII character codes

Character	Dec	Hex
[ctrl-@] NUL	0	$0
[ctrl-A] SOH	1	$1
[ctrl-B] STX	2	$2
[ctrl-C] ETX	3	$3
[ctrl-D] EOT	4	$4
[ctrl-E] ENQ	5	$5
[ctrl-F] ACK	6	$6
[ctrl-G] BEL	7	$7
[ctrl-H] BS	8	$8
[ctrl-I] HT	9	$9
[ctrl-J] LF	10	$l ($0A)
[ctrl-K] VT	11	$0B
[ctrl-L] FF	12	$0C
[ctrl-M] CR	13	$r ($0D)
[ctrl-N] SO	14	$0E
[ctrl-O] SI	15	$0F
[ctrl-P] DLE	16	$10
[ctrl-Q] DC1	17	$11
[ctrl-R] DC2	18	$12
[ctrl-S] DC3	19	$13
[ctrl-T] DC4	20	$14
[ctrl-U] NAK	21	$15
[ctrl-V] SYN	22	$16
[ctrl-W] ETB	23	$17
[ctrl-X] CAN	24	$18
[ctrl-Y] EM	25	$19
[ctrl-Z] SUB	26	$1A
ctrl-[ESC	27	$1B
[ctrl-\] FS	28	$1C
ctrl-] GS	29	$1D
[ctrl-^] RS	30	$1E
[ctrl-_] US	31	$1F

Character	Dec	Hex
SPACE	32	$20
!	33	$21
“	34	$22
#	35	$23
$	36	$24
%	37	$25
&	38	$26
‘	39	$27
(	40	$28
)	41	$29
*	42	$2A
+	43	$2B
,	44	$2C
-	45	$2D
.	46	$2E
/	47	$2F
0	48	$30
1	49	$31
2	50	$32
3	51	$33
4	52	$34
5	53	$35
6	54	$36
7	55	$37
8	56	$38
9	57	$39
:	58	$3A
;	59	$3B
<	60	$3C
=	61	$3D
>	62	$3E
?	63	$3F

Character	Dec	Hex
@	64	$40
A	65	$41
B	66	$42
C	67	$43
D	68	$44
E	69	$45
F	70	$46
G	71	$47
H	72	$48
I	73	$49
J	74	$4A
K	75	$4B
L	76	$4C
M	77	$4D
N	78	$4E
O	79	$4F
P	80	$50
Q	81	$51
R	82	$52
S	83	$53
T	84	$54
U	85	$55
V	86	$56
W	87	$57
X	88	$58
Y	89	$59
Z	90	$5A
[	91	$5B
\	92	$5C
]	93	$5D
^	94	$5E
_	95	$5F

Character	Dec	Hex
‘	96	$60
a	97	$61
b	98	$62
c	99	$63
d	100	$64
e	101	$65
f	102	$66
g	103	$67
h	104	$68
i	105	$69
j	106	$6A
k	107	$6B
l	108	$6C
m	109	$6D
n	110	$6E
o	111	$6F
p	112	$70
q	113	$71
r	114	$72
s	115	$73
t	116	$74
u	117	$75
v	118	$76
w	119	$77
x	120	$78
y	121	$79
z	122	$7A
{	123	$7B
|	124	$7C
}	125	$7D
~	126	$7E
DEL	127	$7F

A

C

D

E

M

O

R

S

T

U

W

Rockwell Automation support

Rockwell Automation provides technical information on the web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator available at http://www.rockwellautomation.com/locations, or contact your local Rockwell Automation representative.

New product satisfaction return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the feedback form, publication RA-DU002.

Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Rockwell Automation Publication 1756-PM013F-EN-P - February 2018

Supersedes Publication 1756-PM013E-EN-P - June 2016