How To Use
Data Communications
with the Watlow
Series 733/734

Total Customer Satisfaction

3 Year Warranty

User's Manual

WATLOW

Contents

How to Use Data Communications with the Watlow Series 733/734

This manual is a supplement to the Series 733/734 Program and Service Manuals. It is for controls with the data communications option. Use in conjunction with the Program and Service manuals.

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NOTE:
This is expert user-level material, and requires previous experience with data comunications.

You Have One of Two Serial Hardware Interfaces

Depending on your unit's model number, you have one of two hardware interfaces:

1) **EIA/TIA-422** for a "multidrop" or (multiple device) network, up to ten devices total; with 4000 ft. network length limit, or **EIA/TIA-423** (EIA/TIA-232 compatible) for one on one communication with a 50 ft. network length limit with a 733/734 (73xx-xxxx-xBxx) and a host computer. Selecting EIA/TIA-422 or EIA/TIA-423 is user selectable via internal switches. See Page 7.

2) **EIA/TIA-485** (73xx-xxxx-xDxx) also for a multidrop network, up to 32 addresses total, and with a 4000 ft. network length limit.

You Can Use One of Two Software Protocols

There are two protocols available to you. Depending on the type of network you need, you must use the correct combination of interface and protocol.

We use **ANSI X3.28 Protocol**, based on ANSI X3.28 - 1976 Subcategories 2.2, and A3, with the EIA/TIA-422 and EIA/TIA-485 interface to run a multiple device network. We also use **XON/XOFF Protocol**, a simpler protocol, to run a two device network with an EIA/TIA-423 interface. XON/XOFF will also work with the EIA/TIA-422 and EIA/TIA-485 interface, but the network is limited to two devices (one computer and a Series 733/734). XON/XOFF Protocol requires no responses to messages like the ANSI X3.28 Protocol does. Likewise, ANSI X3.28 Protocol, which provides a response to every message, will work with the EIA/TIA-423 interface. But again you are limited to one Series 733/734 and a host computer.

To select which protocol you are going to use, go into the Program menu and use the MODE key to advance to the **Prot** prompt. Select either **FULL**, for ANSI X3.28 2.2 - A.3, or **On** for XON - XOFF.

If you are using ANSI X3.28 Protocol, choose an address number for the control under the **Addr** prompt following the Prot prompt. This prompt will only appear if Prot = FULL.

Communications Wiring

To connect your Series 733/734 to a computer, use the next three pages as a reference. Your computer hardware manual will provide more detailed serial port pin information. In the often noisy industrial environments, do not take noise isolation lightly.

EIA/TIA-422 Interface Pinouts

73xx-xxxx-xBxx

The EIA/TIA-422 communications uses a four wire (full duplex) system. There are two separate lines for transmitting, and two lines for receiving data between the computer and the Series 733/734. With EIA/TIA-422 you can have from one to ten Series 733/734 controls connected to a single computer.

This diagram is a **typical** wiring example. The connections on the host computer may vary depending on models. See page 7 for information about serial interfaces. Refer to your computer user's manual for more information.

Figure 1 - EIA/TIA-422 Inter- face, Wiring Dia- gram.

NOTE: The Electronic Industry Associa- tion (EIA) EIA/TIA- 422 standard recommends a maximum 4000 ft. total network distance.
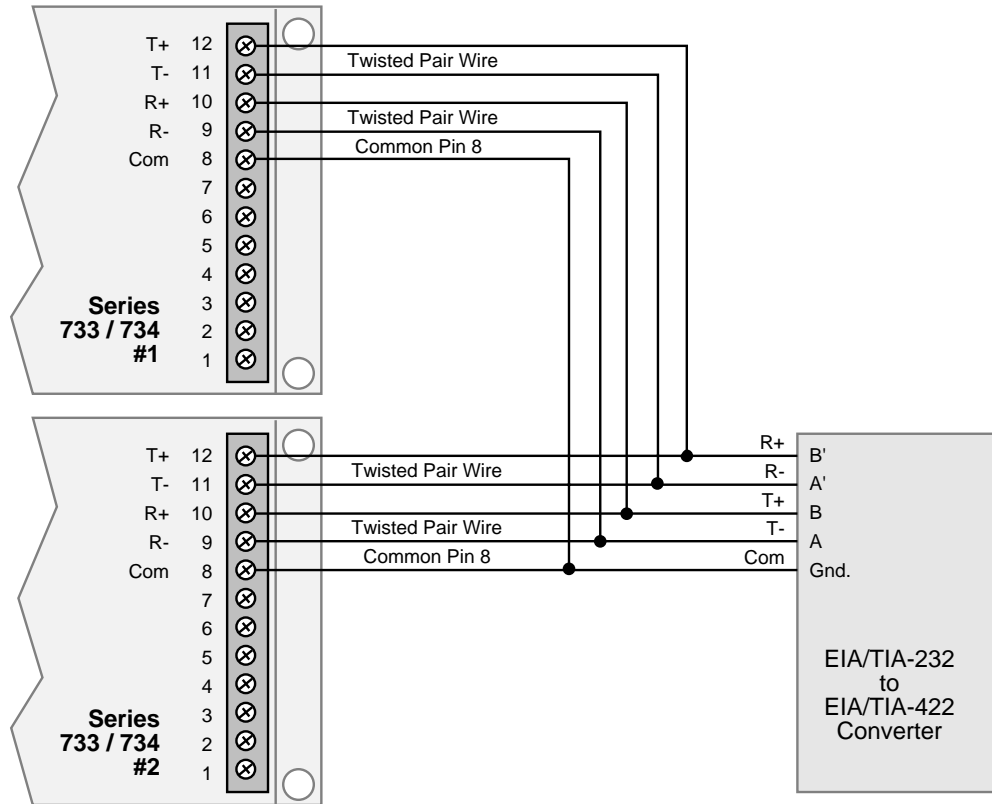
EIA/TIA-485 Interface Pinouts

73xx-xxxx-xDxx

The EIA/TIA-485 communications uses a two wire (half duplex) system. There are only two lines, both lines used for transmitting and receiving. Only one device, the computer or the control, can be speaking at a time. The Series 733/734 requires a 7 millisecond delay between transmission and receipt of data. With EIA/TIA-485 you can have from one to thirty-two Series 733/734 controls connected to a computer.

This diagram is a **typical** wiring example. The connections on the host computer may vary depending on models. See page 7 for information about serial interfaces. Refer to your computer user's manual for more information.

Figure 3 - EIA/TIA-485 Interface, Pin Designations.

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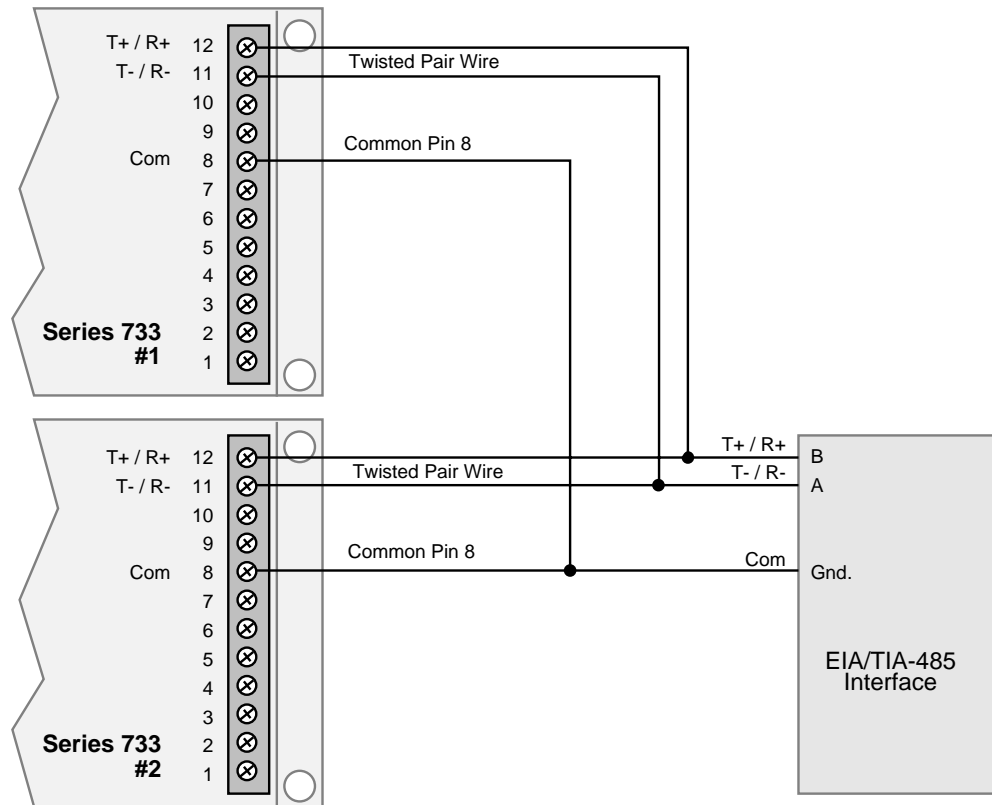
NOTE:
The Electronic Industry Association EIA/TIA-485 standard recommends a maximum 4000 ft. total network distance.

Connecting the Control and the Computer

Remove power from both the Series 733/734 and your computer before connecting them together. This prevents noise or static interference from entering the data communication lines. Assemble a cable and the appropriate wiring at your computer. Refer to the wiring on pages 4 through 6. As soon as you connect the data communications lines, you may apply power to your system.

Series
733/734
(rear view)

EIA/TIA-422 (C2) ← → EIA/TIA-423 (C1)

Communications Board
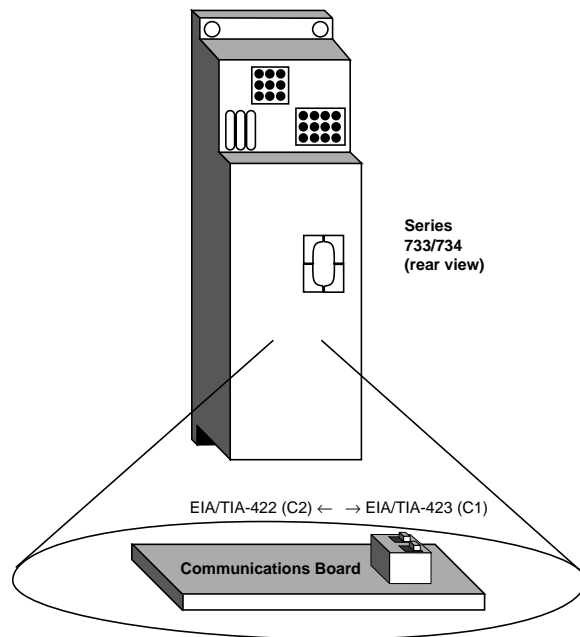
**Figure 4 -
Internal EIA/TIA-422
& EIA/TIA-423 Switch
Location and Selec-
tion.**

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**NOTE:
The Series 733/734
leaves the factory
configured for
EIA/TIA-423 opera-
tion, unless other-
wise requested.**

How to Set the EIA/TIA-422 & EIA/TIA-423 Hardware Protocol Switches for 73xx-xxxx-xBxx Units Only

The EIA/TIA-422 or EIA/TIA-423 switches are on the Communication Module Board (A007-1830) inside the control. Figure 4 shows the approximate location of this board. Select C1 on both switches for EIA/TIA-423, or C2 on both switches for EIA/TIA-422 operation. **Both switches must be set to the same position.**

To change the position of the switches:
Watlow recommends using a properly grounded wrist strap before opening this control.
1)   Remove power from the Series 733/734.
2.   Remove the two snap-on connectors from the back of the unit.
2)   Remove the two rear cover screws from the back of the unit.
3)   Remove the rear cover and locate the switches. See Figure 4.
4)   Set both switches to C1 for EIA/TIA-423, or to C2 for EIA/TIA-422
5)   Replace the rear cover; secure the two rear cover screws.
6.   Re-attach the two snap-on connectors.
7.   Apply power to the control.

Your Computer's Serial Interface:
The Key To Network Connections

You can connect a data communication-equipped Series 733/734 to any computer with an EIA/TIA-422 or EIA/TIA-423 (EIA/TIA-232 compatible) or EIA/TIA-485 serial interface. The IBM™PC® with an EIA/TIA-232 serial output card, for instance, will talk to a single EIA/TIA-423 equipped Series 733/734. For a multiple 733/734 network with the same PC, you'll need an EIA/TIA-232 to EIA/TIA-422 converter to act as a "bus," or multiple connection point.

Watlow recommends the Burr-Brown LDM 422 for that purpose. The address is:
Burr-Brown, Inc., 1141 West Grant Rd,. Suite 131, Tucson, AZ 85705,
Phone: (602) 624-2434, Fax: (602) 623-8965.

For EIA/TIA-485, we recommend the Black Box LD485A-MP.   The address is:
Black Box Corp., Mayview Road at Park Drive, Box 12800, Pittsburgh, PA 15241,
Phone: (412) 746-5530, Fax: (412) 746-0746.

Comms Setup

Program Mode - Communications Prompts

Enter the Program Mode at the front panel: `00.00`

Press key sequence: ▲ 🕐 🌡 🌡 ▼ 🕐

The display shows: `C_F`

Continue pressing: 🕐

Until: `bAUd`

Current value displays alternately: `1200` or `bAUd`

Press to change value: ▲ or ▼

Press for next prompt: 🕐

Press to exit: 🕐

Document any changes.

Enter data on a photocopy of this page.

Table 1 - Program Mode prompts and Descriptions.

Prompt	This Value	Range	Factory Default	Appears…
`bAUd`		(Baud rate) 300, 600, 1200, 2400, 4800, 9600	1200	if comms unit
`dAtA`		7o = 7 data bits and odd parity 7E = 7 data bits and even parity 8n = 8 data bits and no parity (Start bit = 1) (Stop bit = 1)	7o (Fixed) (Fixed)	if comms unit
`Prot`		FULL = ANSI X3.28 2.2 - A.3 On = XON - XOFF	FULL	if comms unit
`Addr`		0 to 31 (ASCII)	0	if Prot = FULL

ASCII Character Set

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
00	00	NUL	16	10	DLE	32	20	SP	48	30	0
01	01	SOH	17	11	DC1	33	21	!	49	31	1
02	02	STX	18	12	DC2	34	22	"	50	32	2
03	03	ETX	19	13	DC3	35	23	#	51	33	3
04	04	EOT	20	14	DC4	36	24	$	52	34	4
05	05	ENQ	21	15	NAK	37	25	%	53	35	5
06	06	ACK	22	16	SYN	38	26	&	54	36	6
07	07	BEL	23	17	ETB	39	27	'	55	37	7
08	08	BS	24	18	CAN	40	28	(	56	38	8
09	09	HT	25	19	EM	41	29	)	57	39	9
10	0A	LF	26	1A	SUB	42	2A	*	58	3A	:
11	0B	VT	27	1B	ESC	43	2B	+	59	3B	;
12	0C	FF	28	1C	FS	44	2C	,	60	3C	<
13	0D	CR	29	1D	GS	45	2D	-	61	3D	=
14	0E	SO	30	1E	RS	46	2E	.	62	3E	>
15	0F	SI	31	1F	US	47	2F	/	63	3F	?

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
64	40	@	80	50	P	96	60	`	112	70	p
65	41	A	81	51	Q	97	61	a	113	71	q
66	42	B	82	52	R	98	62	b	114	72	r
67	43	C	83	53	S	99	63	c	115	73	s
68	44	D	84	54	T	100	64	d	116	74	t
69	45	E	85	55	U	101	65	e	117	75	u
70	46	F	86	56	V	102	66	f	118	76	v
71	47	G	87	57	W	103	67	g	119	77	w
72	48	H	88	58	X	104	68	h	120	78	x
73	49	I	89	59	Y	105	69	i	121	79	y
74	4A	J	90	5A	Z	106	6A	j	122	7A	z
75	4B	K	91	5B	[	107	6B	k	123	7B	{
76	4C	L	92	5C	\	108	6C	l	124	7C		
77	4D	M	93	5D	]	109	6D	m	125	7D	}
78	4E	N	94	5E	^	110	6E	n	126	7E	~
79	4F	O	95	5F	_	111	6F	o	127	7F	DEL

Table 2 - ASCII Character Set.

ASCII Control Characters (Partial Set)

ASCII Char.	Ctrl Key Equiv.	Definition	Dec. Equiv.	Hex. Equiv.
ENQ	Ctrl E	Enquiry	5	05
ACK	Ctrl F	Acknowledge	6	06
NAK	Ctrl U	Neg. Acknowledge	21	15
STX	Ctrl B	Start of Text	2	02
ETX	Ctrl C	End of Text	3	03
EOT	Ctrl D	End of Transmission	4	04
DLE	Ctrl P	Data Link Escape	16	10
CR	Ctrl M	Carriage Return	13	0D
DC1	Ctrl Q	XON	17	11
DC3	Ctrl S	XOFF	19	13

Table 3 - ASCII Control Characters (Partial Set).

Learn Syntax

Series 733/734 General Message Syntax

As soon as you link the devices, you'll be able to talk to the Series 733/734 using ASCII characters.

The Series 733/734 will respond to any Operation or Program prompt, plus some others. The control will respond to either upper or lower case ASCII characters from your computer.

Both protocol/interface combinations will respond to the general syntax, providing the commands or queries are correctly transmitted. However, the ANSI X3.28 Protocol requires beginning and ending characters, and the XON/XOFF Protocol requires ending characters. We'll look at those shortly.

Message Syntax

Messages from your computer to the Series 733/734 must take this general form. All commands do not require the full number of data fields.

Command <space> data.1 <space> data.2 <space> data.3... data.N

"Command" is a character set to which the Series 733/734 will respond. The brackets "< >" enclose a non-literal description. "Space" is simply a delimiter, an ASCII space character (Hex 20). "Data Fields" are prompts and values specific to a command; the number of possible data fields depends on the particular command you use. Data 1 is here abbreviated, "data.1", Data 2 is "data.2" and so on.

In the syntax explanations ahead, we'll show you the specific arguments for each command. It will speed the process, if you remember this general syntax.

Data Rules

Data fields are prompts and values specific to particular commands. These rules govern their use. Specific data for each command is listed later in this chapter.

• Data will be ASCII 0 through 9, unless otherwise noted.
• Data can go up to seven total characters, including a minus sign. A + or - sign, if used, must be first, and it must have a decimal point if applicable.
• Data can use leading zeros. (Up to 7 digits.)
• Data does use decimal points.
• Data.1 portion of message can be up to four total characters.

Command List

These commands, represented by their respective ASCII characters, will enable you to program the Series 733/734 from your computer. More detailed descriptions of the commands are in Table 5, pages 17-19.

?	Finds the value of a specific prompt.	p. 17 - 19
=	Sets a specific prompt to a specific value.	p. 17 - 19

Example Format

For your benefit, we're presenting message/response examples with syntax required for Series 733/734 communication. Information bracketed by < > indicates a description, rather than literal characters. We show each ASCII character that you must transmit to the Series 733/734, including space between the characters. (A "space" is itself an ASCII character, hex 20). For clarity, we also represent each ASCII character as a hexadecimal pair. The pairs are spread apart on the page for easy reading. However, electronic devices "see" the hex pairs all together in "strings," with no spaces in between.

For instance, from the example just below, you want to set the Alarm 1 Low (A1LO) prompt to 500°. Notice the syntax just below which uses the "=" command.
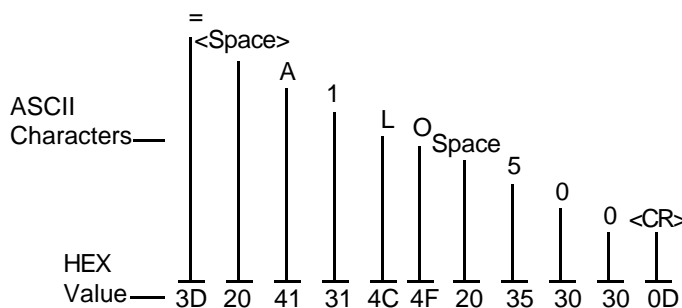
= <space> A1LO <space> 500

Figure 5 - Series 733/734 General Message Syntax Example.

To send this message, key the ASCII characters into your computer, or write them into your program. The computer, in turn, will send a string similar to the one at the bottom of the example, 3D2041314C4F20353030.

Notice that we haven't mentioned protocol here, or any characters added to this syntax by a protocol.   With XON/XOFF, the message above can be transmitted with only an additional Carriage Return <cr> (hex 0D) character at the end. However, the ANSI X3.28 Protocol requires an envelope of Start of Text <STX> (hex 02) and End of Text <ETX> (hex 03) characters around the information you see above. You'll learn how to do that in the pages ahead.

XON/XOFF Protocol for EIA/TIA-423

XON/XOFF (flow control) Protocol allows a communicating device (either a 733/734 or the host) to suspend transmission of all messages from the other device, and then to continue transmission when it's again ready.

The device that needs to suspend transmission sends the XOFF character (hex 13) to stop the other device's transmitter, and XON (hex 11) to restart it. Note that technically any character will restart the transmitter, but only the XON character is not a part of any regular message that may be transferring.

Messages transmit according to the syntax described in the XON/XOFF formats which follow for each command.

The XON/XOFF Protocol requires a Carriage Return <cr> character (hex 0D) at the end of every message.

XON/XOFF "="

How To Start and Stop Communicating with the Series 733/734 and XON/XOFF

Starting communications with **XON/XOFF Protocol** is simple. You just configure your computer to agree with the Series 733/734 communication prompts and open its serial communication port in software. Then begin to "talk" by transmitting a message to the Series 733/734. You stop communicating with XON/XOFF Protocol simply by ceasing to send messages.

XON/XOFF "=" Command Example

The general command syntax is the one you've already seen. Each command uses a slightly different variation of it, depending on the number of arguments required for a message.

• You want to change the Alarm 1 Low (A1LO) value to 500°. The "=" command will do the job.

The syntax with XON/XOFF Protocol requires an ending Carriage Return <cr>.

"=" Command Syntax with XON/XOFF Protocol:
= <space> data.1 <space> data.2 <cr>

With the "=" Command, data.1 is the Series 733/734 prompt, in this case Alarm 1 Low, A1LO. Data.2 is the value you want to set for that prompt, in this example, 500.
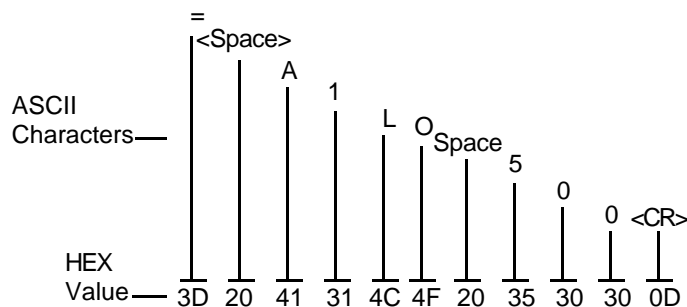
Enter in ASCII:
= <space> A1LO <space> 500 <cr>
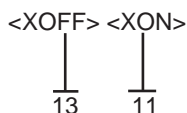The hex string will be:
3D2041314C4F203530300D

Figure 6 - XON/XOFF "=" Command Example.


```
           =
            <Space>
                 A
                   1
ASCII                L  O
Characters            Space
                            5
                             0
                              0  <CR>

HEX
Value  3D  20  41  31  4C  4F  20  35  30  30  0D
```

Response from the Series 733/734:
It sends an "XOFF" when a carriage return is received and then an "XON" when the unit is done processing the command.

• The complete list of Commands is in Table 5, Pages 17-19.


```
<XOFF> <XON>

   13     11
```

XON/XOFF "?" Command Example

You want to know the Alarm 1 Low (A1LO) value. The "?" uses a variation of the message syntax shown just below. **This protocol requires an ending carriage return character.**

"?" Command syntax with XON/XOFF Protocol:
? <space> data.1 <cr>

Enter in ASCII:
? <space> A1LO <cr>
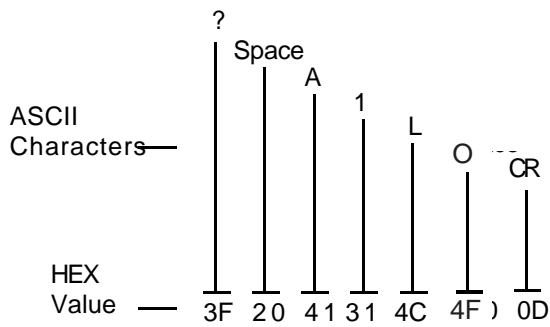The hex string will be:
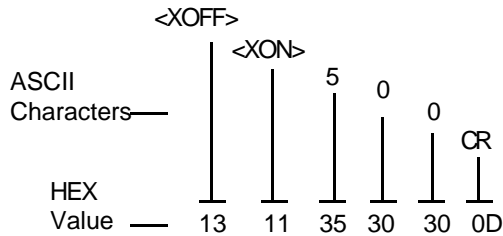3F2041314C4F0D

Figure 7 - XON/XOFF "?" Command Example.

The value of A1LO will be between rL (Range Low) and rH (Range High), say, 500.

Response from the Series 733/734:
<XOFF> <XON> <current value of A1LO> <cr>

The hex response string is:
13113530300D

ANSI X3.28 Protocol for EIA/TIA-422 and EIA/TIA-485

The ANSI X3.28 Protocol provides high quality communications by requiring a response to every message. With a multiple device or "multidrop" network, this protocol prevents confusion among the separate devices. Furthermore, if noise occurs somewhere in the system, no prompt will change because noise can't comply with the protocol.

By placing messages inside a protocol envelope, the messages are protected. In the examples to come you'll see how this works.

The ANSI X3.28 Protocol requires STX characters at the beginning of a message and ETX characters at the end.

Device Address

If you are using the ANSI X3.28 Protocol, you must have a device address (identification) number. A Watlow EIA/TIA-422 multidrop network can handle up to 10 devices with this protocol. EIA/TIA-485 can handle up to 32 devices.

Set the address number with the Series 733/734 in the **Addr** prompt under the Setup menu.

Table 4 - Address to ASCII Conversion.

Address	ASCII Equivalent
0 - 9	0 - 9
10 - 31	A - V

Starting Communications in ANSI X3.28 Protocol

Here's the syntax for starting communications with ANSI X3.28 Protocol. The master device, your computer, must initiate the data link. The example below uses the ASCII number 4 as a Series 733/734 device address.

Enter in ASCII, using this syntax: <Address # 4><ENQ>

```
ASCII            4
Characters          <ENQ>
                  |    |
HEX Value        3 4  0 5
```

Response from the 733/734:
<Address # 4><Acknowledge (ACK)>

```
ASCII
Characters       4
                    <ACK>
                  |    |
HEX Value        3 4  0 6
```

Stopping Communications in ANSI X3.28 Protocol

The master device, your computer, must end communications with Device #4 by using Data Link Escape (DLE) and End of Transmission (EOT) characters.

Enter in ASCII: <DLE> <EOT>

```
ASCII
Characters ——  <DLE>
                      <EOT>

HEX Value ——     10   04
```

Response from the 733/734:
None

ANSI X3.28 "=" Command Example

The "=" Command sets a specific 733/734 prompt to a specific value. The general command syntax applies to all commands. The definition and number of arguments depends on the command itself. See Table 5, Pages 17.

In this example, you want to change the Alarm 1 Low value to 500°. Here, the "=" command will do the job.

'"=" command Syntax with ANSI X3.28 Protocol:
<STX> = <space> data.1 <space> data.2 <ETX>

With the "=" command, data.1 is the Series 733/734 prompt, in this case Alarm 1 Low , A1LO. Data.2 is the value you want to set for that prompt, in this example, 500.

Enter in ASCII:
<STX> = <space> A1LO <space> 500 <optional carriage return> <ETX>
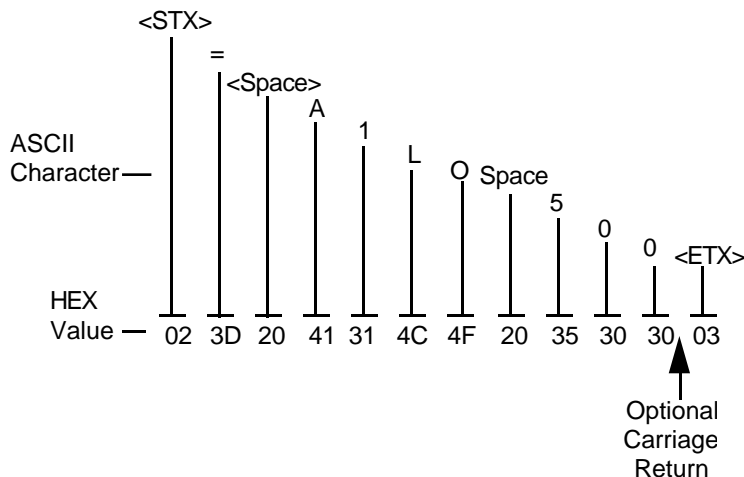The hex string is:
023D2041314C4F2035303003

```
           <STX>
               =
                   <Space>
                        A
                            1
                                 L
                                    O   Space
                                            5
                                               0
                                                  0  <ETX>
ASCII
Character ——
HEX
Value ——   02  3D  20  41  31  4C  4F  20  35  30  30  03
                                                 ↑
                                             Optional
                                             Carriage
                                             Return
```

**Figure 8 -
ANSI X3.28 "="
Command Example.**

Response from the Series 733/734:
<ACK>
The hex response string is:
06

• You'll find the the complete list of "=" command arguments (prompts and value limits) in Table 5, Pages 17-19.

ANSI X3.28 "?" Command Example

You need to know the Alarm 1 Low value (A1LO). The "?" uses a variation of the message syntax shown just below. **This syntax requires the protocol start of text and end of text characters.**

"?" command syntax with ANSI X3.28 Protocol:
<STX> ?<space> <data.1> <ETX>

Enter in ASCII:
<STX> ? <space> <A1LO> <optional carriage return> <ETX>
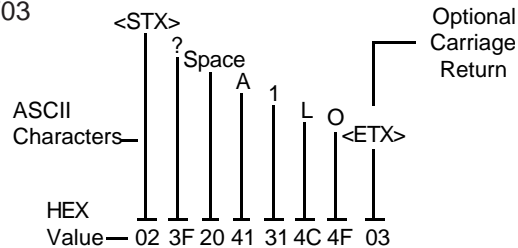The hex string will be:
023F2041314C4F03

**Figure 9 -
ANSI X3.28 "?"
Command Example.**

First response from the Series 733/734:
<ACK>
The <ACK> hex response string is:
06

Your computer's confirming response:
<EOT>
The <EOT> response hex string is:
04

Second response from the Series 733/734:
<STX> <current A1LO value> <carriage return> <ETX>
The hex string is:
023530302003

Your computer's next response:
<ACK> or < NAK> (if the message needs to be repeated).
The hex string is:
06 or 15

Final response from the Series 733/734:
<EOT>
The hex string is:
04

Command Summary Series 733/734 Data Communications

Table 5 - Command Summary with Read (?) and Write (=) Simple Syntax and Data Range/Responses.

Name (data.1)	Description	Read (?) and/or Write (=) Syntax — Add ETX & STX with ANSI X3.28 Protocol	Range (data.2)
A1HI	Zone 1 Alarm High	? <sp> A1HI <cr> = <sp> A1HI <sp> data.2 <cr>	Process Alarm: A1LO to R1H Deviation Alarm: 0 to 555°C/0 to 999°F
A1LO	Zone 1 Alarm Low	? <sp> A1LO <cr> = <sp> A1LO <sp> data.2 <cr>	Process Alarm: R1L to A1HI Deviation Alarm: 0 to -555°C/0 to -999°F
A2HI	Zone 2 Alarm High	? <sp> A2HI <cr> = <sp> A2HI <sp> data.2 <cr>	Process Alarm: A2LO to R2H Deviation Alarm: 0 to 555°C/0 to 999°F or Units
A2LO	Zone 2 Alarm Low	? <sp> A2LO <cr> = <sp> A2LO <sp> data.2 <cr>	Process Alarm: R2L to A2HI Deviation Alarm: 0 to -555°C/0 to -999°F or Units
AL1	Zone 1 Alarm Type	? <sp> AL1 <cr> = <sp> AL1 <sp> data.2 <cr>	0 = Process Alarm 1 = Deviation Alarm 2 = No Alarm
AL2	Zone 2 Alarm Type	? <sp> AL2 <cr> = <sp> AL2 <sp> data.2 <cr>	0 = Process Alarm 1 = Deviation Alarm 2 = No Alarm
ALM	Alarm Status (Writing a 0 will clear all alarms if all alarm conditions no longer exist.)	? <sp> ALM <cr> = <sp> ALM <sp> 0 <cr>	0 = No alarms occurring 1 = A1HI occurring 2 = A1LO occurring 4 = A2HI occurring 8 = A2LO occurring
AUT1	Zone 1 Auto-tune	? <sp> AUT1 <cr> = <sp> AUT1 <sp> data.2 <cr>	0 = No auto-tuning 1 = Slow response tuning 2 = Medium response tuning 3 = Fast response tuning
AUT2	Zone 2 Auto-tune	? <sp> AUT2 <cr> = <sp> AUT2 <sp> data.2 <cr>	0 = No auto-tuning 1 = Slow response tuning 2 = Medium response tuning 3 = Fast response tuning
C1	Zone 1 Process Value	? <sp> C1 <cr>	Between R1L and R1H
C2	Zone 2 Process Value	? <sp> C2 <cr>	Between R2L and R2H
CAL1	Zone 1 Cal Offset	? <sp> CAL1 <cr> = <sp> CAL1 <sp> data.2 <cr>	-99°F to 99°F -55°C to 55°C
CAL2	Zone 2 Cal Offset	? <sp> CAL2 <cr> = <sp> CAL2 <sp> data.2 <cr>	-99°F to 99°F -55°C to 55°C -99 Units to 99 Units
CF	Degrees Select	? <sp> CF <cr> = <sp> CF <sp> data.2 <cr>	0 = Display °F 1 = Display °C
CSP	Current Set Point	? <sp> CSP <sp> zone <cr>	0 = Zone 1 1 = Zone 2
CT1	Zone 1 Cycle Time	? <sp> CT1 <cr> = <sp> CT1 <sp> data.2 <cr>	1 to 60 seconds
CT2	Zone 2 Cycle Time	? <sp> CT2 <cr> = <sp> CT2 <sp> data.2 <cr>	1 to 60 seconds

Table 5 - Command Summary with Read (?) and Write (=) Simple Syntax and Data Range/Responses.

Name (data.1)	Description	Read (?) and/or Write (=) Syntax Add ETX & STX with ANSI X3.28 Protocol	Range (data.2)
ER1	Error 1 Code (Multiple errors possible.)	? <sp> ER1 <cr> = <sp> ER1 <sp> 0 <cr>	0 = No error 1 = ROM error 2 = RAM error 3 = Ambient sensor error 4 = Configuration error 5 = EEprom error 6 = A/D underflow error, Zone 1 7 = A/D overflow error, Zone 1 8 = A/D underflow error, Zone 2 9 = A/D overflow error, Zone 2 10 = Stack overflow error 11 = Open sensor, Zone 1 12 = Shorted sensor, Zone 1 13 = Open sensor, Zone 2 14 = Shorted sensor, Zone 2 15 = Loop error, Zone 1 16 = Loop error, Zone 2
ER2	Error 2 Code	? <sp> ER2 <cr>	0 = No error 1 = Transmit buffer overflow 2 = Receive buffer overflow 3 = Framing error 4 = Overrun error 5 = Parity error 6 = Talking out of turn 7 = Invalid reply error 8 = Noise error 20 = Command not found 21 = Prompt not found 22 = Incomplete command line 23 = Invalid character 24 = Number of chars. overflow 25 = Input out of limit 26 = Read only command 27 = Write allowed only
GB	Guard Band	? <sp> GB <cr> = <sp> GB <sp> data.2 <cr>	1 to 4000°F 1 to 2222°C 1 to 4000 Units
HYS1	Zone 1 Hysteresis	? <sp> HYS1 <cr> = <sp> HYS1 <sp> data.2 <cr>	1 to 99°F 1 to 55°C
HYS2	Zone 2 Hysteresis	? <sp> HYS2 <cr> = <sp> HYS2 <sp> data.2 <cr>	1 to 99°F 1 to 55°C 1 to 99 Units
INP1	Zone 1 Input Type	? <sp> INP1 <cr> = <sp> INP1 <sp> data.2 <cr>	0 = J t/c; 32 to 1382°F/0 to 750°C 1 = K t/c; 32 to 2282°F/0 to 1250°C 2 = E t/c; 32 to 1220°F/0 to 660°C 3 = RTD; 32 to 1112°F/0 to 600°C
INP2	Zone 2 Input Type	? <sp> INP2 <cr> = <sp> INP2 <sp> data.2 <cr>	0 = J t/c; 32 to 1382°F/0 to 750°C 1 = K t/c; 32 to 2282°F/0 to 1250°C 2 = E t/c; 32 to 1220°F/0 to 660°C 3 = RTD; 32 to 1112°F/0 to 600°C 4 = 0-5V; -500 to 3500 units 5 = 4-20mA; -500 to 3500 units 6 = 0-10V; -500 to 3500 units 7 = 0-20mA; -500 to 3500 units
LAT	Alarm Latching	? <sp> LAT <cr> = <sp> LAT <sp> data.2 <cr>	0 = Non-latched alarms 1 = Latched alarms
LOC	Keyboard Lock	? <sp> LOC <cr> = <sp> LOC <sp> data.2 <cr>	0 = Enable prompt change 1 = Disable prompt change
LOOP	Loop Failure	? <sp> LOOP <cr> = <sp> LOOP <sp> data.2 <cr>	0 = Loop fail check OFF 1 = Loop fail check ON
LI	Logic Input Test	? <sp> LI <cr>	Response depends on 733 hardware and LI switch positions. Change a switch and retry; a switch change = logic data chg.

How to Use Data Communications

Name (data.1)	Description	Read (?) and/or Write (=) Syntax Add ETX & STX with ANSI X3.28 Protocol	Range (data.2)
MDKY	Mode Key Action	= <sp> MDKY <sp> 1 <cr>	1 = One MODE Key press
MDL	Model Number Responds 73x-xx-x (See Model # , p. 21)	? <sp> MDL <cr>	x1 = 3 or 4; horiz. or vert. unit x2 & x3 = Last two characters of model #, AA-XX x4 = Software rev; 0-9 or A-X
MENU	Menu Step	? <sp> MENU <sp> menu <sp> step <cr> = <sp> MENU <sp> menu <sp> step <sp> sp1 <sp> sp2 <sp> hours or minutes <sp> minutes or seconds <sp> events <cr>	Data entered must be within individual prompt guidelines, i.e., SP1 = R1L to R1H, etc. Enter data for sp2 and events even if they are not available. See 733/4 Program Manual.
MODE	Mode Status	? <sp> MODE <cr>	0 = Operation mode 1 = Program mode 2 = Setup mode 3 = Service mode 4 = Calibration mode
MS	Melt Cycle	? <sp> MS <cr> = <sp> MS <sp> data.2 <cr>	0 = Melt cycle OFF 1 = Melt cycle ON
PB1	Zone 1 Prop Band	? <sp> PB1 <cr> = <sp> PB1 <sp> data.2 <cr>	0 to 999°F 0 to 555°C
PB2	Zone 2 Prop Band	? <sp> PB2 <cr> = <sp> PB2 <sp> data.2 <cr>	0 to 999°F 0 to 555°C 0 to 999 Units
RA1	Zone 1 Rate	? <sp> RA1 <cr> = <sp> RA1 <sp> data.2 <cr>	0 to 9.99 minutes
RA2	Zone 2 Rate	? <sp> RA2 <cr> = <sp> RA2 <sp> data.2 <cr>	0 to 9.99 minutes
RE1	Zone 1 Reset	? <sp> RE1 <cr> = <sp> RE1 <sp> data.2 <cr>	0 to 9.99 repeats per minute
RE2	Zone 2 Reset	? <sp> RE2 <cr> = <sp> RE2 <sp> data.2 <cr>	0 to 9.99 repeats per minute
RH1	Zone 1 Range High	? <sp> RH1 <cr> = <sp> RH1 <sp> data.2 <cr>	RL1 to max. INP1 type range
RH2	Zone 2 Range High	? <sp> RH2 <cr> = <sp> RH2 <sp> data.2 <cr>	RL2 to max. INP2 type range
RL1	Zone 1 Range Low	? <sp> RL1 <cr> = <sp> RL1 <sp> data.2 <cr>	Min. INP1 type range to RH1
RL2	Zone 2 Range Low	? <sp> RL2 <cr> = <sp> RL2 <sp> data.2 <cr>	Min. INP2 type range to RH2
RTD	RTD Curve	? <sp> RTD <cr> = <sp> RTD <sp> data.2 <cr>	0 = DIN 1 = JIS
RUN	Menu Run	= <sp> RUN <sp> menu <cr>	n = Run Menu n
SIL	Alarm Silence	? <sp> SIL <cr> = <sp> SIL <sp> data.2 <cr>	0 = OFF 1 = ON
STAT	Run Status	? <sp> STAT <cr>	x x; x1=0 idle or 1 run, x2=menu#
STP	Maximum Steps	? <sp> STP <cr> = <sp> STP <sp> data.2 <cr>	1 = 1 Step 2 = 2 Steps 3 = 3 Steps
STOP	Menu Stop	= <sp> STOP menu <cr>	n = Stop Menu n
TCMP	Temperature Compensation	? <sp> TCMP <cr> = <sp> TCMP <sp> data.2 <cr>	0 = OFF 1 = ON
TREM	Time Remaining	? <sp> TREM <cr>	Learn Menu time remaining
TS	Time Select	? <sp> TS <cr> = <sp> TS <sp> data.2 <cr>	0 = minutes : seconds 1 = hours : minutes

Table 5 - Command Summary with Read (?) and Write (=) Simple Syntax and Data Range/Responses.

NAKs and Error Codes

When your message is "not acknowledged" (NAK) in EIA/TIA-422 or EIA/TIA-485 with ANSI X3.28 Protocol, you may clear ER2 codes by reading it. That is, use "?"

Then try the message again; you may have made a syntax error. See the error code listing in Table 5, page 17.

With XON/XOFF protocol and the EIA/TIA-423 interface, the 733/734 sends no feedback on commands. Therefore, you may want to query the status of ER2 after each command you send.

All communications-related error codes are ER2 error codes, that is they are not considered cause for a shutdown of the 733/734 unit itself. There is always a communications error code generated when a <NAK> character is sent under the ANSI X3.28. With XON/XOFF flow control error codes may be generated, but there will be no standard indication of this fact.

⚠ CAUTION:
Sending commands to a particular Series 733/734 for which it is not equipped may cause damage to equipment and/or processes.

User Responsibility ⚠

All data communications commands are available on all models of the Series 733/734 which have communications capability. Users must refrain from altering prompts which do not appear on the Series 733/734 front panel. For example, do not send an A1LO command, page 17, to a Series 733/734 not equipped with alarm outputs.

The exception to this rule concerns the MENU command, which requires valid data for SP2 (Set Point 2) and events, even though the hardware is not present in the particular Series 733/734.

7 3 _ A - _ _ _ _ _ - _ _ A A

733/734 = One or two channel microprocessor-based, time and
temperature control; 24V~ (VAC) power input.
*Order power supply and connector kit(s) separately below.

Display Orientation
3 = Horizontal
4 = Vertical

Display Location
A = Integral (local)

Input Type
1 = Single thermocouple (type J, K E)
2 = Single RTD 1°, curve selectable
4 = Dual thermocouple (type J, K, E); *Order output types 1 & 2*
5 = Dual RTD 1°, curve selectable; *Order output types 1 & 2*
6 = Dual Input: Channel 1 thermocouple (type J, K, E); and Channel 2
process (0-5V⎓ (VDC), 0-10V⎓ (VDC), 0-20mA, 4-20mA), *Order output types 1 & 2*
Dual-zone units must use ungrounded thermocouples.

Output 1 Type
B = Solid-state relay with RC suppression, form A, 0.4A
C = Switched DC, open collector, non-isolated
D = Mechanical relay, form A, 1A, with suppression
E = Mechanical relay, form A, 1A, without suppression
F = Process, 4-20mA, non-isolated
H = Process, 0-5V⎓ (VDC), non-isolated
K = Solid-state relay without RC suppression, form A, 0.4A

Output 2 Type
A = None
B = Solid-state relay with RC suppression, form A, 0.4A
C = Switched DC, open collector, non-isolated
D = Mechanical relay, form A, 1A, with suppression
E = Mechanical relay, form A, 1A, without suppression
F = Process, 4-20mA, non-isolated
H = Process, 0-5V⎓ (VDC), non-isolated
K = Solid-state relay without RC suppression, form A, 0.4A

Event Inputs/Outputs
0 = None
1 = 4 Event outputs, switched DC, non-isolated (custom only)

Alarm
A = None
D = Single mechanical relay, form A, 1A, with suppression

Communications (Isolated)
A = None
B = EIA/TIA-422 or EIA/TIA-423
D = EIA/TIA-485

Options
AA = Standard Single Display

Power Supply, Power Connector and Event Input/Output Accessory Kits (Order separately here.)

Part No.	Description
A001-0249-0001 =	120V~ (VAC) - 24V~ (VAC), stepdown transformer, Class 2, quick connect terminals included.
A001-0249-0002 =	208/240V~ (VAC) - 24V~ (VAC), stepdown transformer, Class 2, quick connect terminals included.
A001-0250-0012 =	Power input connector kit, 12-pin connector assembly, wire not included.
A001-0250-0009 =	Event input/output connector kit, 9-pin connector assembly, wire not included.

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