![AW FLOW METERS logo]

AW FLOW METERS

WE'VE GOT HART ABILITY

AW Flow Meters HART Summary for RT-Ex15

The RT-Ex15-HART follows HART Communication Protocol Revision 6. HART may be used to remotely setup and read the flow of the RT-Ex15 over a 2-wire loop-powered 4-20mA current loop. The RT-Ex15-HART accepts all 20 Universal Commands (Table 1) and implements 9 Device Specific Commands (Table 2). The RT-EX15 communicates only as a non-bursting slave device and must be used in a system with a HART Master Controller.
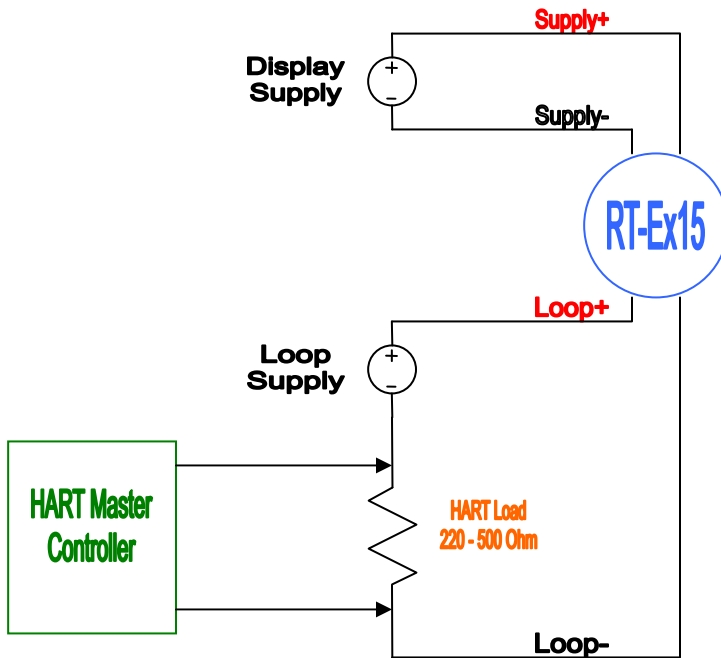
Connections for Single Node
1. RT-Ex15 Display unit requires a 24Vdc supply. See RT-Ex15 manual.
2. A second DC Voltage supply is required to maintain HART Loop Isolation from the RT-Ex15 display. Voltage range is 12 to 24Vdc.
3. A load resistor is required in the HART Loop. This load resistor may be internal to the Master Controller. Minimum value is 220 Ohms. Maximum is 500 Ohms.

HART Protocol Overview

LEADING COMMUNICATION TECHNOLOGY
The HART Protocol is the leading communication technology used with smart process instrumentation today. The HART Protocol continues to grow in popularity and recognition in the industry as a global standard for smart instrument communication. More than two-thirds of all smart instruments shipping today communicate using the HART Protocol.

EASY TO USE
HART is field-proven, easy to use and provides highly capable two-way digital communication simultaneously with the 4-20mA analog signaling used by traditional instrumentation equipment.

UNIQUE COMMUNICATION SOLUTION
Unlike other digital communication technologies, the HART Protocol provides a unique communication solution that is backward compatible with the installed base of instrumentation in use today. This backward compatibility ensures that investments in existing cabling and current control strategies will remain secure well into the future.

Designed to compliment traditional 4-20mA analog signaling, the HART Protocol supports two way digital communications for process measurement and control devices. Applications include remote process variable interrogation, cyclical access to process data, parameter setting and diagnostics.

For more information see the HART Communication Foundations website:
www.hartcomm.org

	ASCII string (packed 4 characters per 3
HART Command Summary	A	bytes)
AW		
Company	b	Bit-Mapped Flags
RTEX15	D	Data (3 bytes: day, month, year-1900
		Floating Point (4 bytes IEEE
Summary	F	754)
	H	Integers
	bF	Bit Field

Universal

Command		Data in Command				Data in Reply				Notes
Nbr	Function	Byte	Type	Function	Byte	Type	Value	Function	Detail	
0	Read Unique Identifier			none	0	B		Expansion code	"254" == expanded command	
					1-2	U16	E083	16-bit Device Code	Was 1 byte Mfg Code + 1 byte Device type for HART 5 & 6	
					3	B	3	Number of Preambles		
					4	B	7	Universal Command Revison	7 is not required even though rest of commands adhere to HART 6.3	
					5	B	10	Transmitter Specific Command Rev	10 --> 1.0	
					6	B	10	Software Rev	10 --> 1.0	
					7	B	1	Hardware Rev & Signaling Code		
					8	B	0	Device Function Flags		
					9-11	U24	tbd	Device ID Number	same as on RT-Ex15 Faceplate	
					12	B	3	Min. number of Slave preambles		
					13	B	0	Max. number of Device Variables		
					14-15	U16		Configuration Chang Counter	16-bit increments with each configuration change	
					16-17	U16	6002	16-bit Manufacturers Code		
					18-19	b	0	16-bit Extended Field Device Status	see Common Table 17	
1	Read Primary Variable			none	0	B		PV Units Code	see "Unit Code" Tab	
					1-4	F		Primary Variable	Rate A PL	
2	Read Current and Percent of Range			none	0-3	F		Current (mA)		
					4-7	F		Percent of Range		

AW FLOW METERS

HART Command Summary A ASCII string (packed 4 characters per 3 bytes)
AW Company b Bit-Mapped Flags
RTEX15 D Data (3 bytes: day, month, year-1900
  Floating Point (4 bytes IEEE
Summary F 754)
  H Integers
  bF Bit Field

Universal

Command		Data in Command			Data in Reply				Notes
Nbr	Function	Byte	Type	Function	Byte	Type	Value	Function	Detail
0	Read Unique Identifier			none	0	B		Expansion code	"254" == expanded command
					1-2	U16	E083	16-bit Device Code	Was 1 byte Mfg Code + 1 byte Device type for HART 5 & 6
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					8	B	0	Device Function Flags	
					9-11	U24	tbd	Device ID Number	same as on RT-Ex15 Faceplate
					12	B	3	Min. number of Slave preambles	
					13	B	0	Max. number of Device Variables	
					14-15	U16		Configuration Chang Counter	16-bit increments with each configuration change
					16-17	U16	6002	16-bit Manufacturers Code	
					18-19	b	0	16-bit Extended Field Device Status	see Common Table 17
1	Read Primary Variable			none	0	B		PV Units Code	see "Unit Code" Tab
					1-4	F		Primary Variable	Rate A PL
2	Read Current and Percent of Range			none	0-3	F		Current (mA)	
					4-7	F		Percent of Range	

AW FLOW METERS

HART Command Summary	A	ASCII string (packed 4 characters per 3 bytes)	
AW Company	b	Bit-Mapped Flags	
RTEX15	D	Data (3 bytes: day, month, year-1900	
		Floating Point (4 bytes IEEE	
Summary	F	754)	
	H	Integers	
	bF	Bit Field	

Universal

Command		Data in Command			Data in Reply				Notes
Nbr	Function	Byte	Type	Function	Byte	Type	Value	Function	Detail
3	Read Current and Four (predefined) Dynamic Variables			none	0-3	F		Current (mA)	
					4	B		PV Units Code	see "Unit Code" Tab
					5-8	F		Primary Variable	Rate A PL
					9	B		SV Units Code	see "Unit Code" Tab
					10-13	F		Secondary Variable	Rate A GT
					14	B		TV Units Code	see "Unit Code" Tab
					15-18	F		Third Variable	Total A (Job Total)
					19	B		FV Units Code	see "Unit Code" Tab
					20-23	F		Fourth Variable	Grand Total
6	Write Polling Address	0	byte	Polling Address	0	byte		Polling Address	0 <= PA <= 15
7	Read Loop Configuration			none	0	byte		Polling Address	
					1	byte		Loop Current Mode	0 == disabled (fixed at 4.0mA) 1==enabled (Loop Current Reflects PV)
8	Read Dynamic Variable Classifications			none	0	byte		PV Classification	see Common Table 21
					1	byte		SV Classification	
					2	byte		TV Classification	
					3	byte		QV Classification	
9	Read Device Variables with Status	0	byte	Device Variable Code 0	0	byte		Extended Field Device Status	(see Common Table 17)
		1	byte	Device Variable Code 1	1	byte		Slot 0: Device Variable Code 0	RT-Ex15 Rev 1.0 does not have any HART readable device variables. So up to 4 Dynamic Variables are returned
		2	byte	Device Variable Code 2	2	byte		Slot 0: Device Variable Classification	PV Classification

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HART Command Summary   A   ASCII string (packed 4 characters per 3 bytes)

AW Company   b   Bit-Mapped Flags

RTEX15   D   Data (3 bytes: day, month, year-1900

                        Floating Point (4 bytes IEEE

Summary   F   754)

                       H   Integers

                       bF   Bit Field

Universal

Command		Data in Command			Data in Reply				Notes
Nbr	Function	Byte	Type	Function	Byte	Type	Value	Function	Detail
9 Continued		3	byte	Device Variable Code 3	3	byte		Slot 0: Units Code	PV Units Code
					4-7	F		Slot 0: Device Variable Value	PV is returned
					8	byte		Slot 0: Device Variable Status	PV Status
					9-17			Repeat for Slot 1:	SV data if requested
					18-26			Repeat for Slot 2:	TV data if requested
					27-35			Repeat for Slot 3:	QV data if requested
11	Read Unique Identifier Associated With Tag	0-5	A	Tag	0-19			Same as Command 0	Tag is 8 characters
12	Read Message			none	0-23	A		Message	32 characters
13	Read Tag, Descriptor, Data			none	0-5	A		Tag	8 characters
					6-17	A		Descriptor	16 characters
					18-20	D		Date	
14	Read PV Sensor Information			none	0-2	U24	0	Transducer Serial Number	Not used by RT-Ex15
					3	B	FA	Units Code for Transducer Limits & Min Span	
					4-7	F	0	Upper Transducer Limit	
					8-11	F	0	Lower Transducer Limit	
					12-15	F	0	Minimum Span	
15	Read Output Information			none	0	B	FA	Alarm Select Code	Not used by RT-Ex15
					1	B	FA	Transfer Function Code	
					2	B	FA	PV/Range Units Code	
					3-6	F	0	Upper Range Value	
					7-10	F	0	Lower Range Value	
					11-14	F	0	Damping Value (seconds)	
					15	B	FB	Write-Protect Code	
					16	B	FA	Private-Label Distributor Code	

	A	ASCII string (packed 4 characters per 3 bytes)
	b	Bit-Mapped Flags
	D	Data (3 bytes: day, month, year-1900
	F	Floating Point (4 bytes IEEE 754)
	H	Integers
	bF	Bit Field

Universal

Command		Data in Command			Data in Reply					Notes
Nbr	Function	Byte	Type	Function	Byte	Type	Value	Function	Detail	
16	Read Final Assembly Number			none	0-2	U24	0	Final Assembly Number	end user read & write	
17	Write Message	0-23		Message	0-23	A		Echo Command Data	end user read & write	
18	Write Tag, Descriptor, Date	0-5	A	Tag				Echo Command Data		
		6-17	A	Descriptor						
		18-20	D	Date						
19	Write Final Assembly Number	0-2	U24	Final Assembly Number	0-2	U24	0	Echo Command Data		
20	Read Long Tag			none	0-31	A		32-character Full ISO Latin-1 ASCII		
21	Read Unique Identifier Associated with Long Tag	0-31	A	Long Tag				Same as Command 0	Long Tag is 32 characters	
22	Write Long Tag	0-31	A	Long Tag	0-31	A		Echo Command Data		

AW HART Commands for RT-Ex15

Device Specific

| Command | | Data in Command | | | | Data in Reply | | | | Notes |
Nbr	Function	Byte	Type	Function	Byte	Type	Value	Function	Detail
128	Read Rate Setup Variables	0	B	Channel Number	0	B		Channel Number	
					1-4	F		KFR	K-Factor for Rate
					5-8	F		Gate Time (in Seconds)	
					9	B		Rate Engineering Units Code	for Rate PL method
					10	B		Sample Size	
					11	b		Decimal Point Location	
					12	b		Rate Variable Status	1
129	Write Rate Setup Variables	0	B	Channel Number	0	B		Channel Number	
		1-4	F	KFR	1-4	F		KFR	K-Factor for Rate
		5-8	F	Gate Time (in Seconds)	5-8	F		Gate Time (in Seconds)	
		9	B	Rate Engineering Units Code	9	B		Rate Engineering Units Code	for Rate PL method
		10	B	Sample Size	10	B		Sample Size	
		11	b	Decimal Point Location	11	b		Decimal Point Location	
					12	b		Rate Variable Status	1
130	Read Total Setup Variables	0	B	Channel Number	0	B		Channel Number	
					1-4	F		KFT	K-Factor for Total
					5	B		Total Engineering Units Code	
					6	b		Decimal Point Location	
					7	b		Total Variable Status	
131	Write Total Setup Variables	0	B	Channel Number	0	B		Channel Number	
		1-4	F	KFT	1-4	F		KFT	K-Factor for Total
		5	B	Total Engineering Units Code	5	B		Total Engineering Units Code	
		6	b	Decimal Point Location	6	b		Decimal Point Location	
					7	b		Total Variable Status	
132	Read Analog Setup Variables			none	0-3	F		Span	Value at Maximum mA
					4	B		Span Engineering Units Code	Must match Rate or Total units code
					5-8	F		Zero	mA Offset = lowest current in mA
					9	b		Analog Point	Which PV maps to Analog Output 00 = Rate A GT 01 = Rate A PL 02 = Total A
					10	b		Analog Output Status	

Device Specific

Command		Data in Command			Data in Reply				Notes
Nbr	Function	Byte	Type	Function	Byte	Type	Value	Function	Detail
133	Write Analog Setup Variables	0-3	F	Span	0-3	F		Span	Value at Maximum mA
		4	B	Span Engineering Units Code	4	B		Span Engineering Units Code	Must match Rate or Total units code
		5-8	F	Zero	5-8	F		Zero	mA Offset = lowest current in mA
		9	b	Analog Point	9	b		Analog Point	Which PV maps to Analog Output 00 = Rate A GT 01 = Rate A PL 02 = Total A
					10	b		Analog Output Status	
134	Read Limit Setup Variables	0	B	Channel Number	0	B		Channel Number	
					1	B		Function Code	What DV Effects Limit 00 = Rate A GT 01 = Rate A PL 02 = Total A 03 = Cycle Out
					2-5	F		Limit Value (or Cycle Value)	
					6	B		Limit Engineering Units Code	Must match Rate or Total units code as appropriate
					7-10	F		Margin	same units as Limit
					11	b		Limit Output Status	
135	Write Limit Setup Variables	0	B	Channel Number	0	B		Channel Number	
		1	B	Function Code	1	B		Function Code	What DV Effects Limit 00 = Rate A GT 01 = Rate A PL 02 = Total A 03 = Cycle Out
		2-5	F	Limit Value (or Cycle Value)	2-5	F		Limit Value (or Cycle Value)	
		6	B	Limit Engineering Units Code	6	B		Limit Engineering Units Code	Must match Rate or Total units code as appropriate
		7-10	F	Margin	7-10	F		Margin	same units as Limit
		11	b	Limit Output Status	11	b		Limit Output Status	
136	Reset Total	0	B	Channel Number	0	B		Channel Number	What Total is set to 0 00 = Total A (Job Total) 01 = Grand Total A

Multiple RT-EX15s with a Single HART Controller

To additional RT-EX15s.

To additional RT-EX15s.

Loop Power Supply

I_{LOOP}

Display Supply

24 Vdc

HART Master Controller

HART Load 200-250 Ohm (SEE NOTE 3)
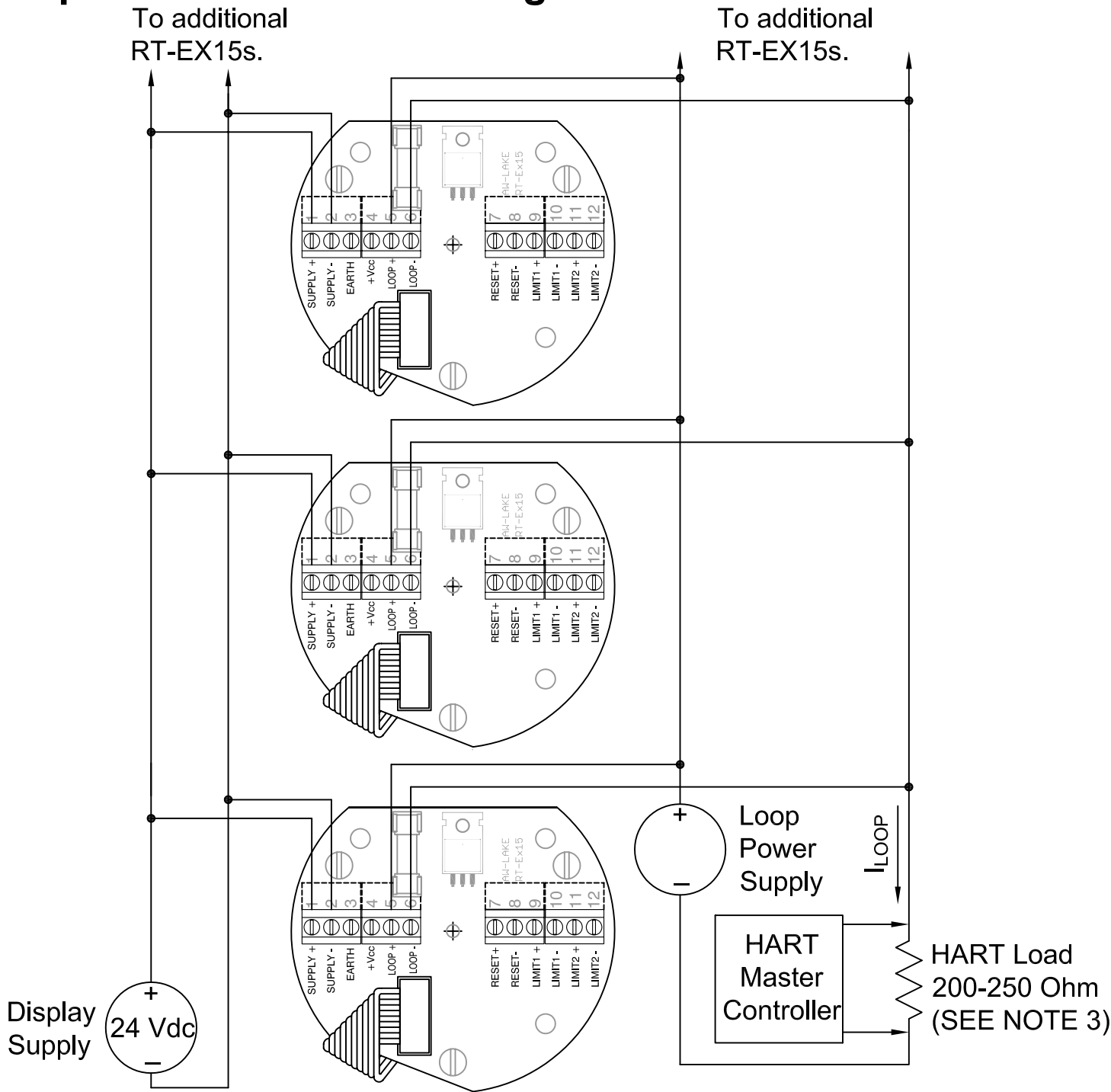
NOTES:

1) IN ORDER TO PRODUCE CONSTANT MINIMUM 4 MA OUTPUT FOR MULTI-DROP HART CONFIGURATION ALL RT-EX15 ANALOG POINT VARIABLES MUST BE SET TO RATE A GT, RATE AT MAX MA'S SET TO LARGEST POSSIBLE VALUE (Largest possible value depends on KFR decimal places, example for two decimal places 9,999.99 GPM)

2) $I_{LOOP} \geq N \times 4$ mA WHERE N = NUMBER OF DEVICES (TYPICAL N_{MAX} =15, I_{MAX}= 60 mA). CONSULT HART MASTER CONTROLLER SPECIFICATIONS FOR SPECIFIC LIMITS AND RATINGS.

3) TYPICAL LOAD VALUE. CONSULT HART MASTER CONTROLLER SPECIFICATIONS FOR INDIVIDUAL LOAD SPECIFICATION.

REV.	DESCRIPTION OF CHANGE	DATE	BY
B	Update HART Notes, Add Nmax&Imax	07-02-07	FJ
B	CHANGE FOR CONNECT BRD CB40014	06-28-07	FJ
A	INITIAL RELEASE	08-17-06	FJ

TITLE: HART CONNECTION TO MULTIPLE RT-EX15s.
DRAWING NUMBER: RTEX15102C
DATE: 07-02-07 REV: C DRAWN BY: FRED JACOBSON
CHECKED BY: F.J. PAGE 1 OF 1 SCALE: NONE