® MOORE
INDUSTRIES

April 2016
224-747-00 B

HART ® Fault Alarm

HFA

HFA HART® Fault Alarm

WE'VE GOT

HART
FIELD COMMUNICATIONS PROTOCOL

ABILITY

This page is left blank intentionally.

Table of Contents

List of Illustrations and Tables

This page is left blank intentionally.

MOORE
INDUSTRIES
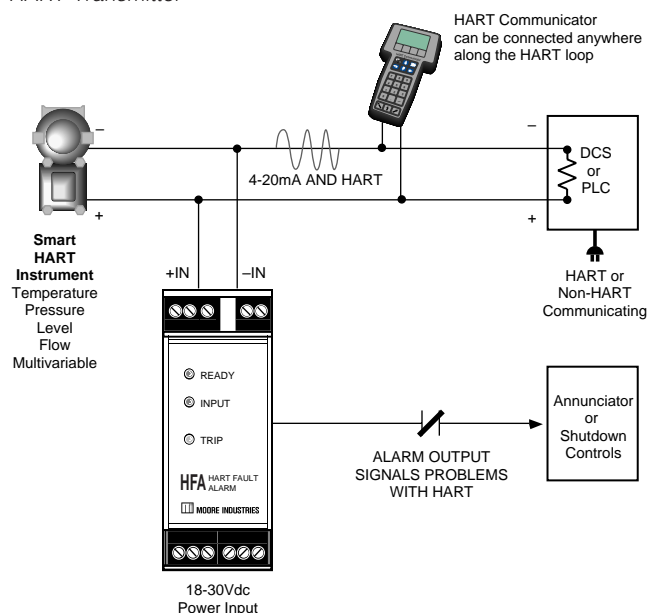*The Interface Solution Experts*

www.miinet.com

What is the HART®₁ Fault Alarm?

The HART Fault Alarm, or HFA, is a 4-wire, DIN-style alarm trip transmitter. It provides a contact-closure output in the event of a problem as indicated by the "status byte" of the digital signal from a HART transmitter. Also, it provides on-site indication of HART malfunctions by means of multi-color LEDs on the front panel.

See Figure 1.

Figure 1. *The HFA HART Fault Alarm Monitors the "Health" of a HART Transmitter*

What Does It Do?

The HFA can be connected anywhere in an existing HART instrumentation loop. It is powered externally by 18-30Vdc.

When powered, the HFA monitors the status byte of a HART transmitter in Normal Mode (as opposed to Burst Mode), and provides an alarm trip signal if:

- There is a HART transmitter malfunction (bit 7)

- There is more HART status data being transmitted (bit 4)

- The HART transmitters' Primary Variable has become fixed (bit 3)

- The HART transmitter's Primary Variable has become saturated (bit 2)

- The HART transmitter's Primary Variable is beyond its range setting (bit 0)

- The HART transmitters' Non-Primary Variable is beyond its range setting (bit 1)

LEDs

There are three LEDs on the HFA front panel. These change color during operation to indicate an alarm condition.

The "TRIP" LED glows green when the HFA is correctly wired, and is receiving a proper HART signal from a connected HART transmitter. It changes to red whenever there is an alarm condition; a problem with the HART transmitter.

The "READY" LED is an ON/OFF light. It shows green when all the conditions for HFA operation—like power, and proper hardware/internal software—are present and working. If power to the HFA is lost, this LED goes out (extinguishes).

The "INPUT" LED shows green as long as the HFA is communicating properly with the connected HART transmitter. In the event of a communications failure, the INPUT LED turns red.

Manual Reset

The HFA is equipped with a set of Manual Reset terminals. Typically, these terminals are connected to an external switch or on/off push button. If the alarm is set for latching function, it will remain tripped until the terminals are shorted then opened to clear the alarm.

Transmitter Excitation Option

Also, the standard HFA can be used in application where the loop is over-burdened. It has an optional excitation current that can be used to provide 24Vdc power to a transmitter.

1 HART is a registered trademark of the HART Communication Foundation.

HFA

What Are the HFA Specifications?

Performance	**Alarm Response Time** (Defined as the time from field instrument's reporting a fault until HFA trips): H* + 150 milliseconds (msec), max. + period for # of Retries and Delay setting **Alarm Trip Delay** (Configured w/number of Retries setting): 0, 3, 6, or 9 seconds **Isolation:** 1000Vrms between case, input, and output **Power Consumption:** 0.8 to 1.4W, nominal; 2.5W with TX option installed **Input Over-Range Protection:** ±5Vdc *H = HART Foundation specifies 500msec response time in Normal Mode, 333msec in Burst Mode	**Ambient Conditions Ratings**	**Operating Temperature Range:** –25 to 85°C (–13 to 185°F) **Storage Temperature Range:** –40 to 85°C (–40 to 185°F) **Relative Humidity:** 0 to 95%, non-condensing **RFI/EMI Protection:** 30V/M - ABC ≤ with no effect on operation		
		Adjustments	Easy-access, internal DIP switch sets: HART Primary/Secondary Master status; HART Normal/Burst Mode; Trip on bit 0, 1, 2, 3, 4, 7, or any bit of HART status byte		

Adjustments (continued)	DIP switch also sets: Latching/Non-Latching relay function; # of Retries and Alarm Trip Delay (0, 3, 6, or 9 seconds); # of Retries + Delay or # of Retries only
Indicators	**LEDs:** TRIP LED shows green for non-alarm condition, red for alarm; READY LED is on during normal operation, off in the event of a failure/alarm; INPUT LED shows green for input with valid HART communications, red for comms failure
Weight	337 g (11.9 oz)

How to Order More HFAs

To order additional or replacement HFAs, use the infomration printed in bold in the table below. "Build" a model number based on the examples at the bottom of the table.

For more help, call your local Moore Industries Interface Solutions Sales Representative, or call the factory.

Unit	Input	Output	Power	Option	Housing
HFA HART Fault Alarm	**HART** 4-20mA into 250Ω with digital data superimposed (HART version 4.5 or later); accepts HART input directly from a HART temperature, pressure, level, flow, or multivariable transmitter	**1PRG** Single-Pole/Double-throw HART Fault alarm Configurable for Failsafe or Non-Failsafe, Latching or Non-Latching operation (Relay rated 1 Form C, 5A @ 250Vac, 50/60Hz, non-inductive)	**18-30DC** 18-30Vdc, ±10%	**-TX** Transmitter Excitation enables HFA to provide power to the HART transmitter; 24Vdc, ±5%, 23mA	**DIN** Universal DIN-style housing mounts on 32mm G-type rail (EN50035), and 35mm Top Hat DIN rail (EN50022)

When ordering, specify: Unit / Input / Output / Power / Option [Housing]
Model number example: HFA / HART / 1PRG / 18-30DC / -TX [DIN]

How to Set Up the HFA for Use

Before installing the HFA into its application, it should be checked to make sure it survived shipping in optimum condition. Also, it will probably be necessary to program its operating parameters to match operational requirements.

This section comprises procedures that outline how to:

- Partially dis-assemble the HFA to check or change the settings of the internal DIP switch control

and

- Check or change the setting for the internal jumper that controls the HFA's relay Failsafe/Non-Failsafe function

Note:
All of the procedures in this section
should be carried out in a lab
or at a technicians' bench
(as opposed to "in the field").
Always adhere to all local safety regulations.

What are the HFA Default Settings?

Each HFA is tested at the factory prior to shipment. It is set up as follows, unless the customer has specified some other setting(s) prior to shipment:

- PRIMARY HART Master
- NORMAL HART Operating Mode
- ALARM ON ANY BIT of the HART Status Byte
- NON-LATCHING Relay Function
- 3 RETRIES/3 SECONDS DELAY
- FAILSAFE RELAY FUNCTION
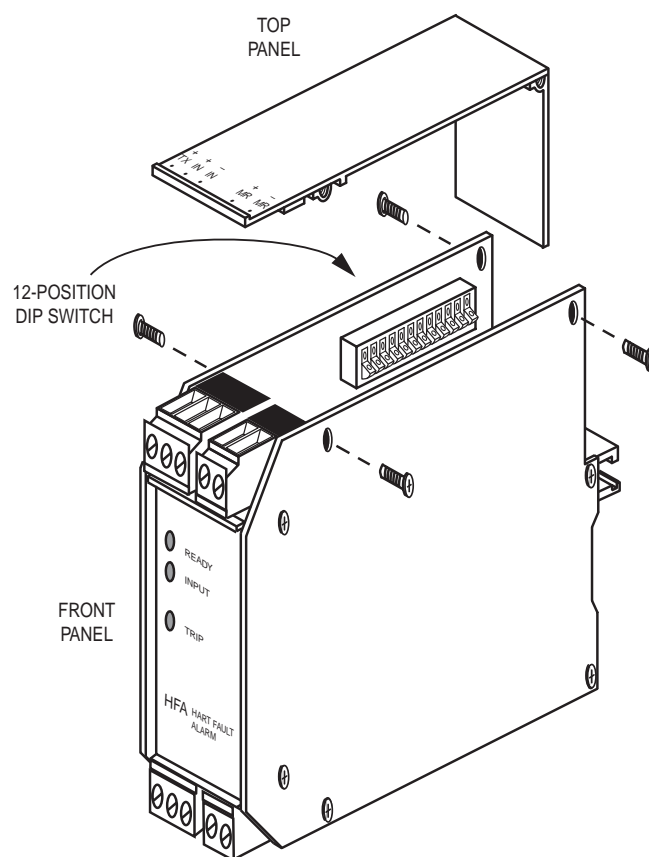
How to Access the HFA DIP Switch

Cautation:
Always exercise care, when opening the housing of
the HFA, to prevent the discharge
of static electricity.
Moore Industries recommends that all procedures in
this section be performed by personnel familiar with
all local regulations and precautions regarding ESD
(electro-static discharge) safeguards.

To access the DIP switch that controls the operational settings for the HFA (except for Failsafe/Non-failsafe, the instructions for which start on page 5), you will need a phillips-head screwdriver.

Access the DIP switch by taking off the the top panel of the HFA. Remove the four phillips-head screws that hold the panel in place. See Figure 2 below.

Figure 2. *Accessing the HFA Configuration DIP Switches.*

HFA

How to Set the HFA DIP Switch

Once the top panel of the unit has been removed, refer to Figure 3 and Table 1 for help in setting the DIP switches as appropriate for the intended HFA application. Refer to your HART documentation for a more detailed explanation of what each operating parameter means.

Figure 3. *How to Tell ON from OFF on the HFA DIP Switch*
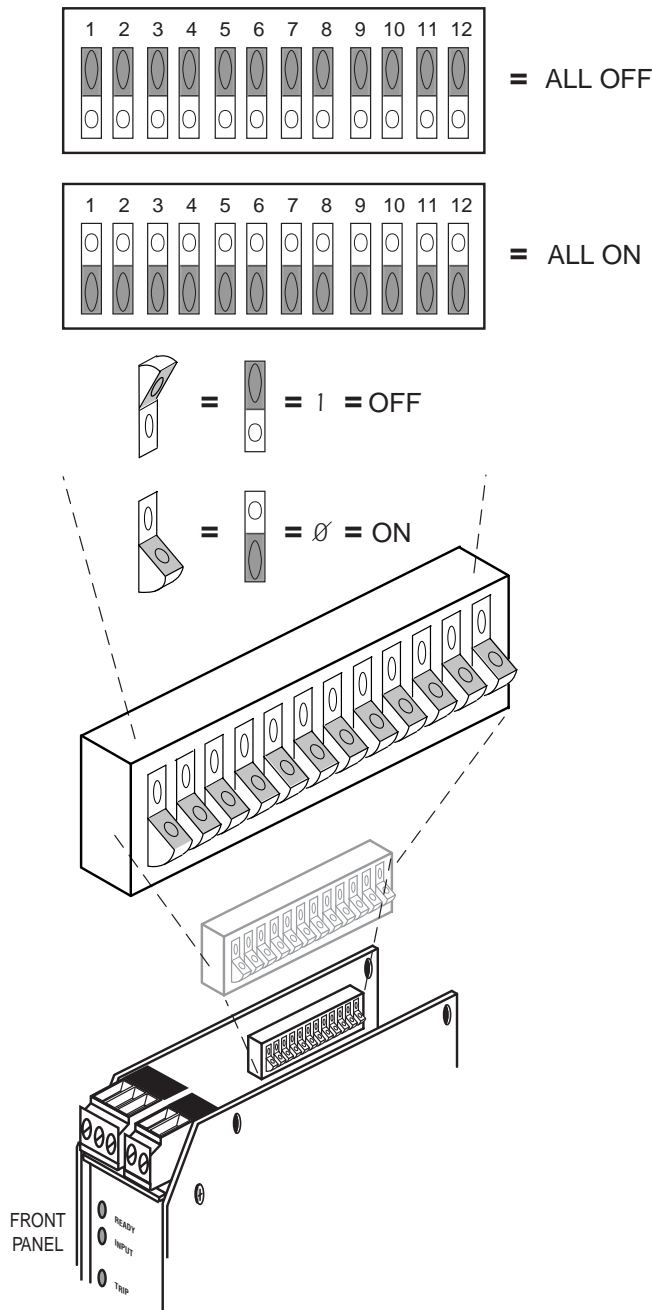
Switch Number	Function	Factory Default
1	Primary/Secondary HART Master	ON, Primary HART Master
2	Normal Mode/Burst Mode	ON, Normal Mode
3	Alarm on BIT 7	ON
4	Alarm on BIT 4	ON
5	Alarm on BIT 3	ON
6	Alarm on BIT 2	ON
7	Alarm on BIT 1	ON
8	Alarm BIT 0	ON
9	Latching ON/OFF	OFF, Non-Latching
10	Number of Retries & Delay	3 Retries & 3 secs Delay
11	Number of Retries & Delay	3 Retries & 3 secs Delay
12	No. of Retries Only/ No.of Retries + Delay	OFF (No. of Retries + Delay)

What Do the Switch Settings Mean?

Refer to your HART documentation for more detailed explanations of the various HART functions of the HFA. Here is the "shorthand" version of the meanings for switches 3 through 8.

Switch 3 .. Bit 7 ..... Field Device Malfunction

Switch 4 .. Bit 4 ..... More HART Status Data Available

Switch 5 .. Bit 3 ..... Primary Variable (typically Analog Output) Fixed

Switch 6 .. Bit 2 ..... Primary Variable Saturated

Switch 7 .. Bit 1 ..... Non-Primary Variable Out of Range Limit

Switch 8 .. Bit 0 ..... Primary Variable Out of Range Limit

Note:
Switches 3 through 8 work independently.
Set them all to ON for the HFA to provide an alarm on any bit.

Number of Retries & Alarm Delay: Setting Switches 10, 11, and 12

As shown in Table 1, switches 10 and 11 control the HFA alarm delay and the number of retries. DIP switch 12 determines how switches number 10 and 11 function in the HFA.

Here's how this works. When first connected to a Smart transmitter (and power), the HFA immediately begins polling the transmitter for its status.

If switch number 12 is ON (factory default)...

The HFA trips (indicates a fault) if there is a HART communications failure with the HART transmitter. *It trips immediately after the delay setting has elapsed.* The delay is determined by the settings of switches 10 and 11.

If switch number 12 is OFF...

The HFA first executes the number of retries determined by the setting of switches 10 and 11. *Then*, assuming there is no HART response, it begins the delay (also set with switches 10 and 11), and trips after that delay has elapsed.

The purpose of this capability is to preclude the HFA's tripping on a "busy signal" from a HART transmitter. Many HART transmitters are designed to buffer their response to queries while performing certain calculative or logic functions. The HFA can be set to allow for this (switch 12 OFF) by executing a number of retries to establish communication with the transmitter, then delaying *while continuing to poll(query)* before returning a HART fault trip. If the HART transmitter responds to the HFA at any time, either during the number of retries or during the delay, communications are established and the HFA does not issue an alarm.
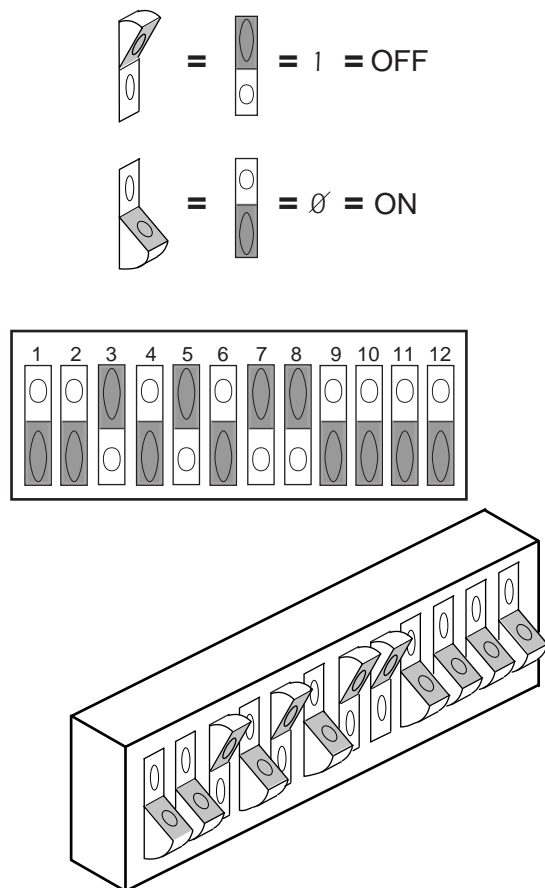
Table 2 lists the available settings determined by switches 10 and 11. Remember, if switch number 12 is ON, 10 and 11 set delay ONLY.

Table 2. *Setting Number of HART Retries and Alarm Delay*

Alarm Delay/ Number of Retries	Switch 10 Setting	Switch 11 Setting
0 seconds / 2	OFF (1)	OFF (1)
3 seconds / 3	ON (0)	OFF (1)
6 seconds / 4	OFF (1)	ON (0)
9 seconds / 5	ON (0)	ON (0)

Examples, DIP Switch Settings

Here are some examples of what the HFA DIP switch should look like for:

- Primary Master, Normal Mode, Alarm on BIT 4 or BIT 2, Latch, 9 second alarm delay, 5 Retries, and Retries + Delay.

Figure 4. *DIP Switch Settings Example 1*

HFA

- Secondary Master, Burst Mode, Alarm on BIT 1 ONLY, Non-Latching, 0 second alarm delay (2 retries), and alarm delay ONLY.

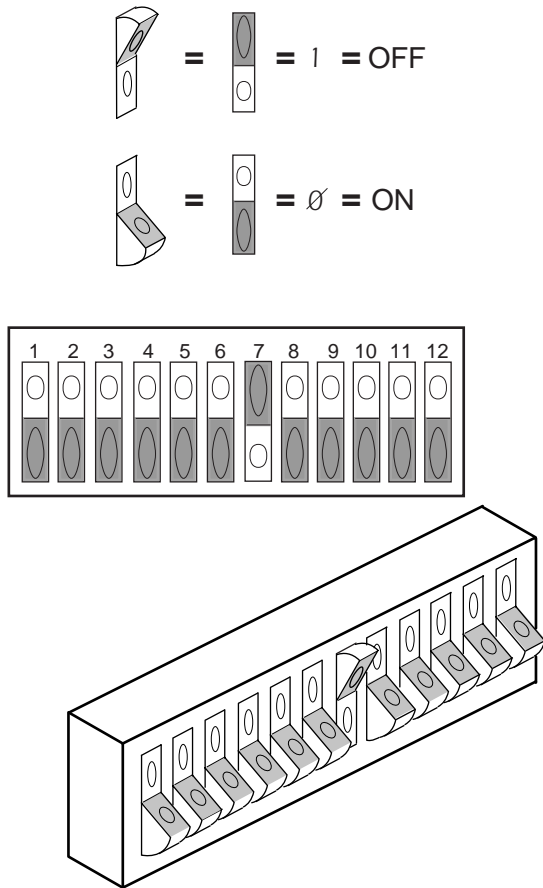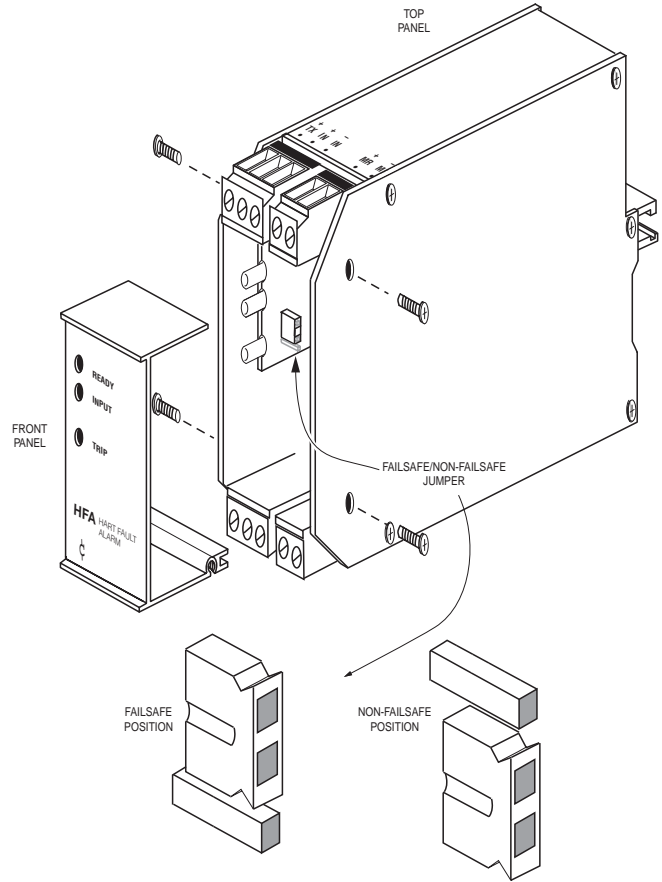*Figure 5. DIP Switch Settings Example 2*

Figure 6. Changing the HFA Failsafe/Non-Failsafe Jumper

Setting the HFA Failsafe/Non-Failsafe Jumper

The failsafe/non-failsafe functioning of the HFA can also be set by the user. Factory default is FAILSAFE, but you can change that to non-failsafe by changing the position of an internal jumper located under the unit from panel.

To access the jumper, remove the four screws that secure the front panel in place. See Figure 6.

How to Install the HFA

When all of the internal settings have been verified or changed according to the requirements of the intended application, the unit is ready to be installed.
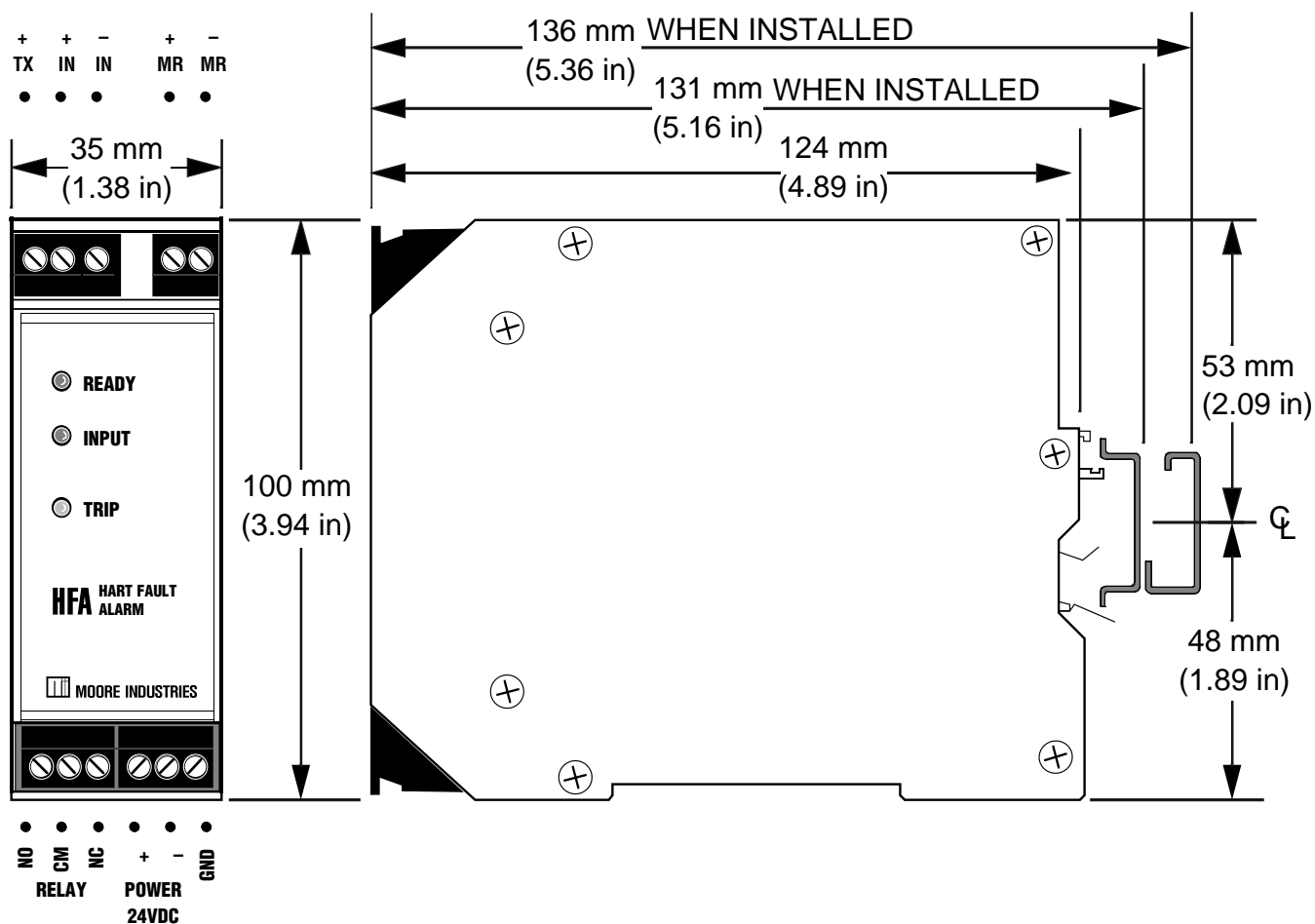
Notes:
It is recommended that the HFA be physically mounted in its intended application before making electrical connections.

Make sure to follow any local regulations regarding the installation of electronic equipment, especially in hazardous or instrisically safe applications.
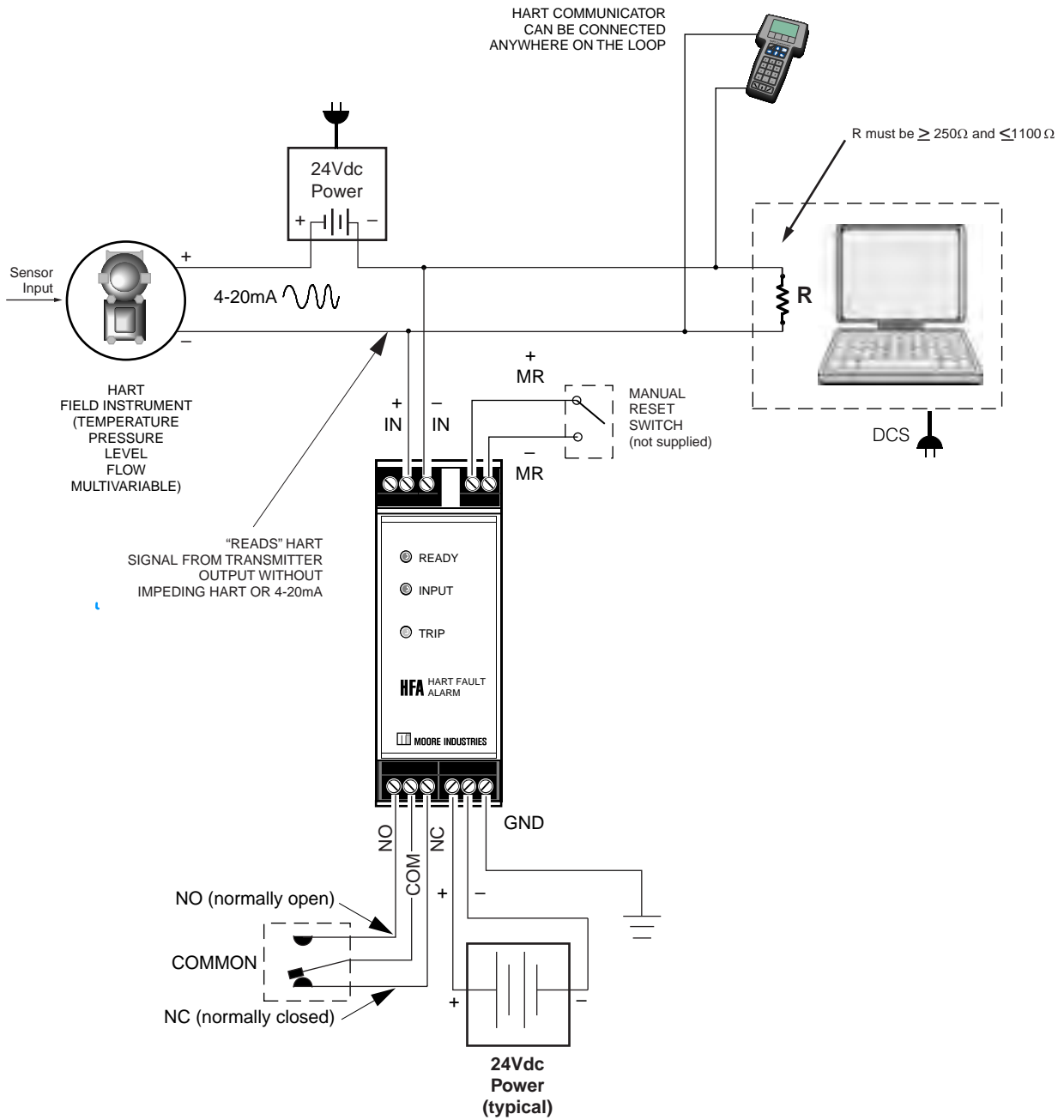
Figure 7 gives the installation dimensions of the HFA. Refer to Figure 8 for an illustration of a typical HFA installation.

Figure 9 shows the HFA in an application where it is used to provide power to the Smart transmitter whose function it is monitoring (transmitter excitation, -TX option required).
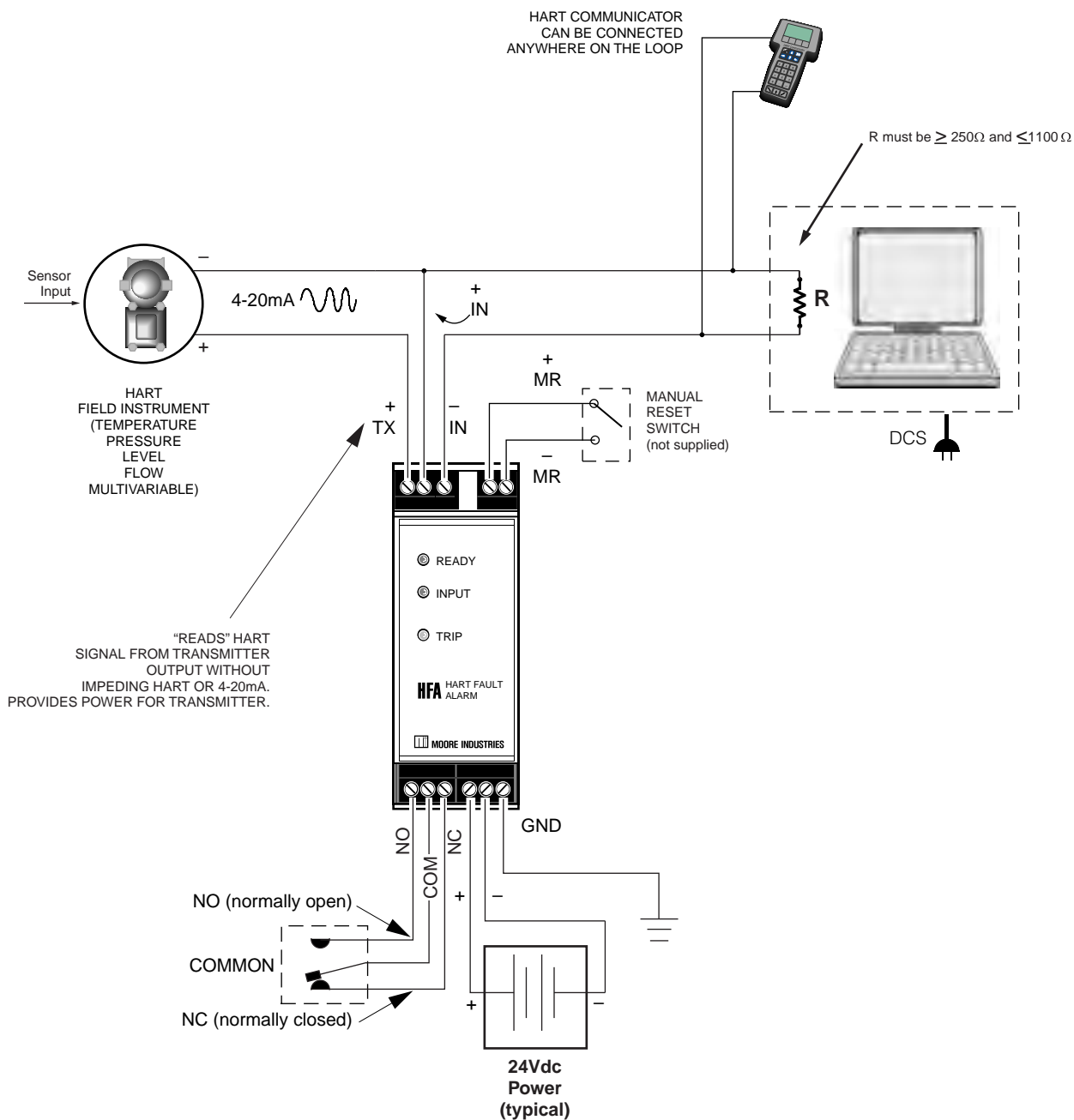
Figure 7. *HFA Installation Dimensions*

HFA

Figure 8. *Connecting the HFA in a Typical Application*

HART COMMUNICATOR
CAN BE CONNECTED
ANYWHERE ON THE LOOP

R must be $\geq 250\Omega$ and $\leq 1100\,\Omega$

24Vdc
Power

Sensor
Input

4-20mA

R

HART
FIELD INSTRUMENT
(TEMPERATURE
PRESSURE
LEVEL
FLOW
MULTIVARIABLE)

DCS

+
MR

+
IN

−
IN

−
MR

MANUAL
RESET
SWITCH
(not supplied)

"READS" HART
SIGNAL FROM TRANSMITTER
OUTPUT WITHOUT
IMPEDING HART OR 4-20mA

○ READY

○ INPUT

○ TRIP

HFA HART FAULT
ALARM

▥ MOORE INDUSTRIES

NO

COM

NC

GND

NO (normally open)

COMMON

NC (normally closed)

+

−

**24Vdc
Power
(typical)**

+

−

Figure 9. *Connecting the HFA in an Application using its Transmitter Excitation Option (-TX)*

HART COMMUNICATOR
CAN BE CONNECTED
ANYWHERE ON THE LOOP

R must be $\geq 250\,\Omega$ and $\leq 1100\,\Omega$

Sensor
Input

4-20mA

+
IN

R

DCS

HART
FIELD INSTRUMENT
(TEMPERATURE
PRESSURE
LEVEL
FLOW
MULTIVARIABLE)

+
TX

IN

+
MR

−
MR

MANUAL
RESET
SWITCH
(not supplied)

"READS" HART
SIGNAL FROM TRANSMITTER
OUTPUT WITHOUT
IMPEDING HART OR 4-20mA.
PROVIDES POWER FOR TRANSMITTER.

READY

INPUT

TRIP

HFA HART FAULT
ALARM

MOORE INDUSTRIES

NO

COM

NC

GND

NO (normally open)

COMMON

NC (normally closed)

+

−

+

−

**24Vdc
Power
(typical)**

HFA

Grounding the HFA

Moore Industries recommends the following guidelines be adhered to when installing the HFA. These guidelines *must* be followed for the unit to meet the specifications in EMC Directives EN50082-2 and EN55011.

WARNING!
If the following guidelines are not followed, the protection provided by the HFA may be impaired.

Housing
The metalic case of the HFA must be grounded. This can be acheived by mounting the unit on a grounded DIN-style rail.

Wiring
Twisted pair, shielded wiring should be used for all inputs and output signals. Shields are to be grounded at the unit, to earth ground (safety ground). The unshielded part of the input/output wiring should be no longer than 51 mm (approximately 2 in).

Protective Earth Conductor
A protective earth conductor should be supplied for each installation of HFAs. It should be of equal or larger size wire than the two power conducting wires.

This protective conductor should be the first thing connected to the unit as part of installation, and the last thing removed if the unit is being removed.

Other Installation Information

- HFA terminals are rated CAT II.

- All supply wiring connections should be made with 14 or 16 AWG (0.083 mm or 0.064 mm) wire. The ends of power conductor connections should be stripped no more than 8 mm (0.32 in). The stripped end of each wire should be tinned with solder, or inserted into a ferrule and crimped before being placed into a terminal block.

- Moore Industries Alarms do not generate hazardous voltages. Alarm contacts are wired in series with power sources and their intended loads. The correct load should be selected for the power source.

- The maximum, working voltage for the contact-closure outputs of the HFA is 30Vdc.

Operation

There is little to "do", once the HFA has been installed in your application. Its output is a contact closure signal that it typically hooked to a current-driven warning device such as a light or buzzer. An HFA "alarm" means that you have a problem with your HART loop, the nature of which depends upon the HFA settings you have chosen.

LEDs

In addition to its alarm output, the HFA has a set of 3 LEDs on its front panel to provide on-site indication of an alarm condition.

The "TRIP" LED
This light glows green when the HFA is correctly wired, has power, and is receiving a proper HART signal from a connected HART transmitter. It changes to red whenever there is an alarm condition. An alarm condition can be a problem with the HART transmitter or with the HFA itself.

The "READY" LED
This indicator is an ON/OFF light. It shows green when all the conditions for HFA operation—like power, and correct hookups—are present and working. If there is an alarm situation, or if power to the HFA is lost, this LED goes out (extinguishes).

The "INPUT" LED
This LED shows green as long as the HFA is communicating properly with the connected HART transmitter. In the event of a communications failure, the INPUT LED turns red.

Manual Reset

Many of Moore Industries' alarms can be equipped with Manual Reset terminals. These provide a convenient means of resetting the alarm after a trip/fault/failure has been cleared from the system.

The HFA's Manual Reset terminals (see Figures 7, 8, or 9) should be wired to a switch or an on/off push-button. If the alarm is set for latching function (refer to page 4), the HFA will, once it trips on a fault/failure condition, remain "in alarm" until the Manual Reset terminals are shorted and then opened. If a switch or on/off device is hooked to these terminals, when the HFA trips, you must close the switch and then re-open the switch to "clear" the alarm.

If the HFA is configured with non-latching alarm function, the Manual Reset terminals are not needed. The HFA's indication of an alarm condition clears itself as soon as the circumstance(s) prompting the alarm are corrected.

Alarm Terminology, Failsafe/Non-Failsafe

The HFA is shipped, by default, as a failsafe alarm. This means that the contacts of the alarm relay are non-energized in an alarm condition. That is, a *failure* produces an ostensibly *safe* condition in the alarm circuit.

If this parameter is changed (refer to page 6), then the alarm would be termed *non-failsafe*; its relay contacts would energize in an alarm condition (being non-energized in non-alarm).

For information on how alarm trips work, including detailed discussions of these and the other terms associated with alarms and the types of alarms Moore Industries manufactures, ask your local Sales Representative for a copy of our Technical Bulletin, *Alarm Trips: the Ups and Downs*. You can also obtain a copy by contacting the factory directly.

Maintenance

Maintenance on Moore Industries' products is limited to keeping the unit clean and its connection terminals free of oxidation. This is best accomplished by installing the unit in an area protected from dust, heat, moisture, and corrosive atmospheres. Yearly visual inspections should be performed to ensure that the unit is clean and that the electrical connections are in good repair.

Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customers, both in our superior products and our dedication to service both before and after the sale.

As part of living up to that reputation, we perform a battery of stringent quality assurance checks on every unit we ship. If any Moore Industries product ever fails to perform up to its rated specifications, call us for help. Our highly skilled staff of trained technicans and engineers pride themselves on their ability to provide timely, accurate, and practical answers to your process instrumentation questions and problems. Factory phone numbers can be found on the back cover of this booklet.

If problems involve a particular HFA, there are several pieces of information that you can gather **before** calling the factory that will help our staff get you the answers you need more efficiently.

When you call, please have:

- the model number of the unit (found on a metallic tag affixed to the side panel)

- the serial number of the unit (found on the same metallic tag)

- the job number under which the unit was shipped (optional)

- the purchase order number under which the unit was shipped (optional)

Your satisfaction is more than a cliché to us; it is a corporate goal. Please feel free to send us your comments, questions, criticisms, or ideas, anytime. You can reach us by phone at USA (818) 894-7111, by E-mail at **cservice@miinet.com**, or via our website at **www.miinet.com**.

MOORE
INDUSTRIES
The Interface Solution Experts

www.miinet.com

Moore Industries

ST★R CENTER

Providing Instrumentation fast from our Quick-Ship Facilities!

READY TO SHIP

- Signal Transmitters
- Temperature Transmitters
- I-to-P and P-to-I Converters
- Isolators and Converters
- Distributed I/O and Data Communications
- Alarm Trips
- Integrators and Totalizers
- Power Transducers
- Instrument Power Supplies
- Racks, Rails, and Enclosures

IN STOCK

FAST REPAIRS TOO!

If you need it today—It's on its way! Call us NOW.

United States
1-800-999-2900

United Kingdom
0800 525107

Australia
(02) 9525-9177

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

W O R L D W I D E • www.miinet.com

MOORE INDUSTRIES

United States • info@miinet.com
Tel: (818) 894-7111 • FAX: (818) 891-2816
Australia • sales@mooreind.com.au
Tel: (02) 8536-7200 • FAX: (02) 9525-7296

Belgium • info@mooreind.be
Tel: 03/448.10.18 • FAX: 03/440.17.97
The Netherlands • sales@mooreind.nl
Tel: (0)344-617971 • FAX: (0)344-615920

China • sales@mooreind.sh.cn
Tel: 86-21-62491499 • FAX: 86-21-62490635
United Kingdom • sales@mooreind.com
Tel: 01293 514488 • FAX: 01293 536852