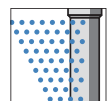


Technical Reference Manual LFXG®

FiberFlex® Detector with GEN2000®
Electronics for Level Measurement



Document ID:
31401



Revision history

Table 1: Revision history

Version	Description	Date
1.0	Initial release. Formerly 240694.	051201
1.1	Electronics Revision	090309
1.2	Added certification information and IECex label	090819
1.3	Changed company name, logo, and website	110301

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ISO 9001 approval by Lloyd's Register Quality Assurance Limited, to the following Quality Management System Standards: ISO 9001:2000, ANSI/ASQC Q9001-2000, Approval Certificate No. 107563.

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WARNING

Use this equipment only in the manner that this manual describes. If you do not use the equipment per VEGA specifications, the unit is not CE compliant, and may be damaged or cause personal injury.

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Explanation of symbols

Table 2 lists the symbols that the manual and instrument use.

Table 2: Explanation of symbols

	<p>Radiation notice</p> <p>In the manual, information concerning radioactive materials or radiation safety information is found in the accompanying text.</p>
	<p>Caution! The text next to this symbol contains the warning of potential damage to equipment or people.</p> <p>Attention! Le texte apparaissant près de ce symbole vous informe d'un danger possible pour l'équipement ou pour l'utilisateur.</p>
	<p>AC current or voltage</p> <p>On the instrument, a terminal to which or from which an alternating (sine wave) current or voltage may be applied or supplied.</p>
	<p>DC current or voltage</p> <p>On the instrument, a terminal to which or from which a direct current voltage may be applied or supplied.</p>
	<p>Potentially hazardous voltages</p> <p>On the instrument, a terminal on which potentially hazardous voltage exists.</p>

Notes

HART software screens

The two charts that follow illustrate the offline and online HART[®] communication screens. For complete illustrations of all HART hand-held communicator menus and screens, see “Appendix IV”.

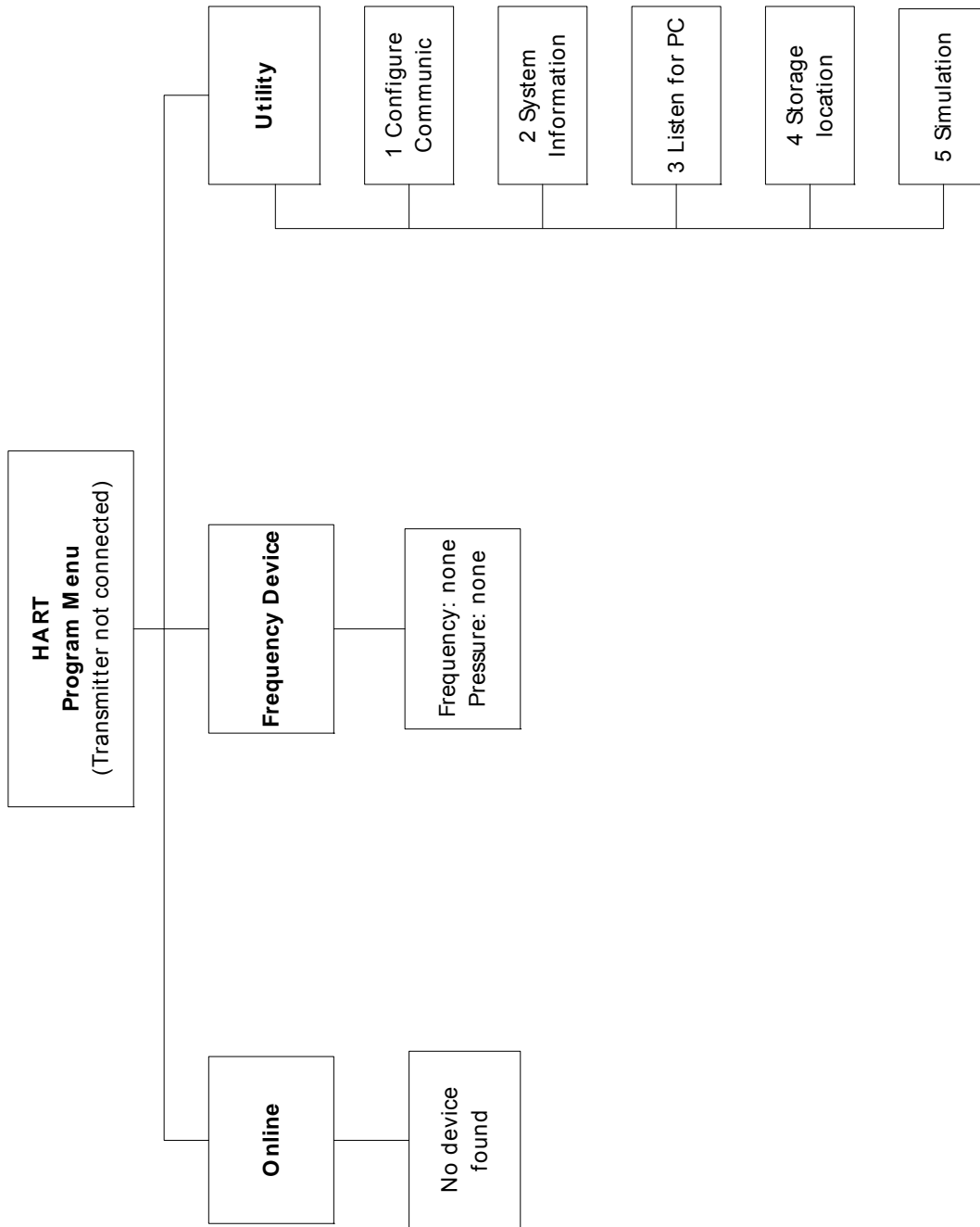


Figure 1: HART screen—gauge not connected

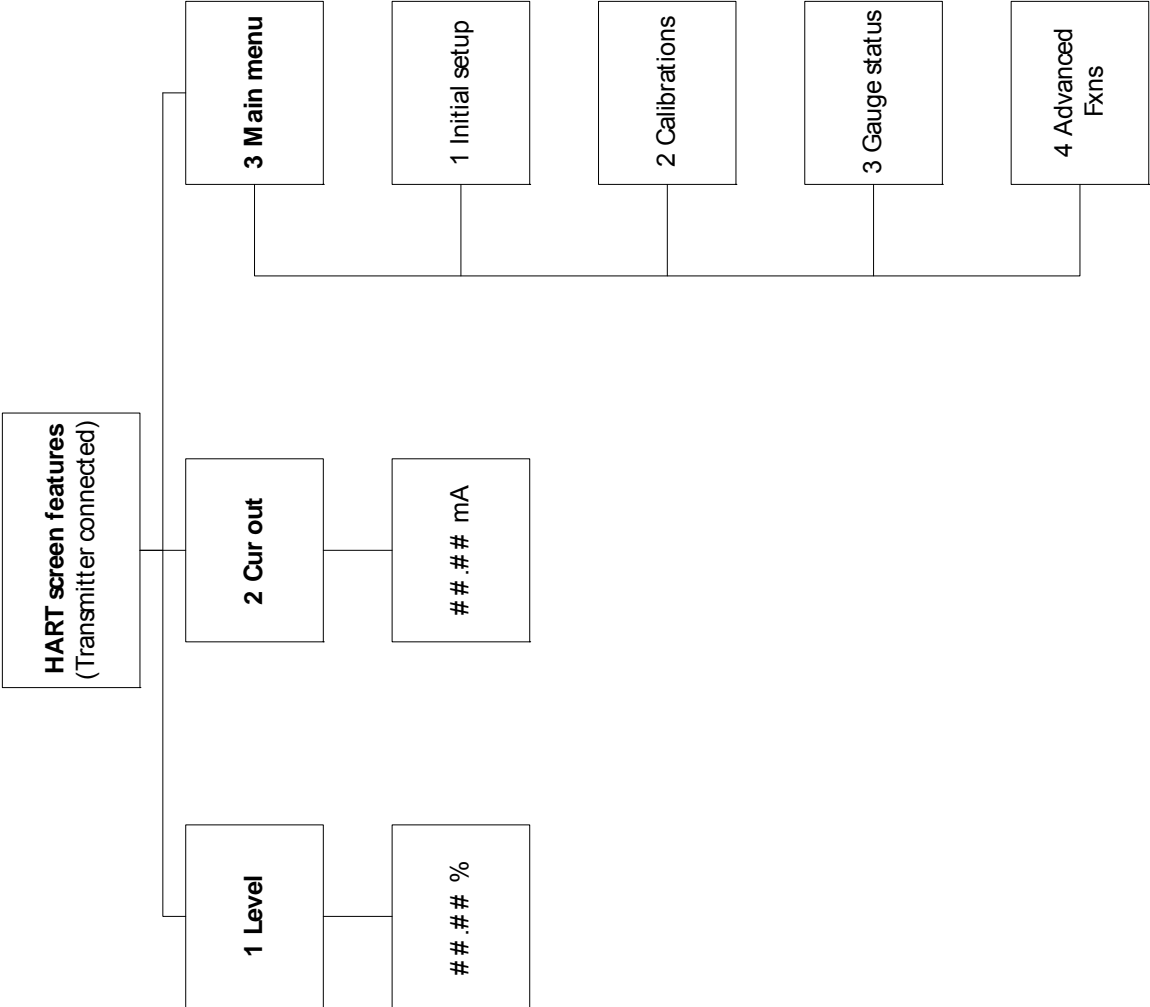


Figure 2: HART screen—gauge connected

Your comments

VEGA values your opinion! Please fill out this page so that we can continually improve our technical documentation.

Manual: LFXG-H Technical Reference Manual

Date: _____

Customer Order Number: _____

How we can contact you (optional if you prefer to remain anonymous):

Name: _____

Title: _____

Company: _____

Address: _____

Did you find errors in this manual? If so, specify the error and page number.

Did you find this manual understandable, usable, and well organized? Please make suggestions for improvement.

Was information you needed or would find helpful not in this manual? Please specify.

Please send this page to:

VEGA Americas, Inc.
Director of Engineering
4241 Allendorf Drive
Cincinnati, OH 45209-1599

Notes

Chapter 1: Introduction

Nuclear materials notice

This equipment contains radioactive source material that emits gamma radiation. Gamma radiation is a form of high-energy electromagnetic radiation. Only persons with a specific license from the U.S. NRC (or other regulating body) may perform the following to the source holder:

- Dismantle
- Install
- Maintain
- Relocate
- Repair
- Test

VEGA Field Service engineers have the specific license to install and commission nuclear gauges, and can instruct you in the safe operation of your level gauge. To contact VEGA Field Service, call 513-272-0131. Users outside the U.S. and Canada may contact their local representative for parts and service.



Note: Special instructions concerning your source holder are found in the envelope that was shipped with the source holder and the “Radiation Safety for U.S. General and Specific Licensees, Canadian, and International Users” manual and the “Radiation Safety Manual Addendum of Reference Information” CD. Please refer to this document for radiation safety information.

Unpacking the equipment



CAUTION!

Make sure that you are familiar with radiation safety practices in accordance with your U.S. Agreement State, U.S. NRC, or your country's applicable regulations before unpacking the equipment.

- ☑ Unpack the unit in a clean, dry area
- ☑ Inspect the shipment for completeness, by checking against the packing slip
- ☑ Inspect the shipment for damage during shipment or storage
- ☑ If the detector is included as a separate package in the shipment, inspect the assembly for damage that may have occurred during shipment or storage
- ☑ If there was damage to the unit during shipment, file a claim against the carrier, reporting the damage in detail. Any claim on the VEGA for shortages, errors in shipment, etc., must be made within 30 days of receipt of the shipment
- ☑ If you need to return the equipment, see the section "Returning equipment for repair to VEGA" in the "Diagnostics and Repair" chapter
- ☑ After you unpack the equipment, inspect each source holder in the shipment to assure that the operating handle is in the OFF position. In the event that you find the handle in the ON position, place it in the OFF position immediately and secure it.



Note: Most source holder models accept a lock. Call VEGA Field Service immediately for further instructions, at 513-272-0131, if the source holder has one of the following conditions:

- Does accept a lock and there is no lock on it
- The lock is not secured
- You are unable to secure the lock
- The operating handle does not properly move into the off position



Note: Low activity source holders have different requirements than the typical source holders. For example, since they usually do not have shutters – the shutter check test is not required. Contact VEGA for further information regarding the low activity source holders.

Storing the equipment

Storing the source holder

If it is necessary to store the source holder, do so in a clean, dry area. Be sure the source holder shutter is in the OFF or CLOSED position. Check the current local regulations (U.S. NRC, Agreement State, or other) to determine if this area must have any restrictions.

Storing the detector

Avoid storage at temperatures below freezing. Store the detector indoors in an area that has temperature-control between +10 °C and +35 °C (+50 °F and +95 °F) and less than 50% relative humidity. Store equipment in dry conditions until installation.

Certifications

This gauge is designed for certification compliance from the following agencies:

- ATEX Standard
- CCOE (India)
- CEPEL/INMETRO (Brazil)
- CSA
- FM Standard
- GOST-B Standard
- GOST-R Standard
- IECex
- JIS (Japan)
- KTL (Korea)
- NEPSI (China)

Safety Information for EX Areas

Please note the EX-specific safety information for installation and operation in EX areas.

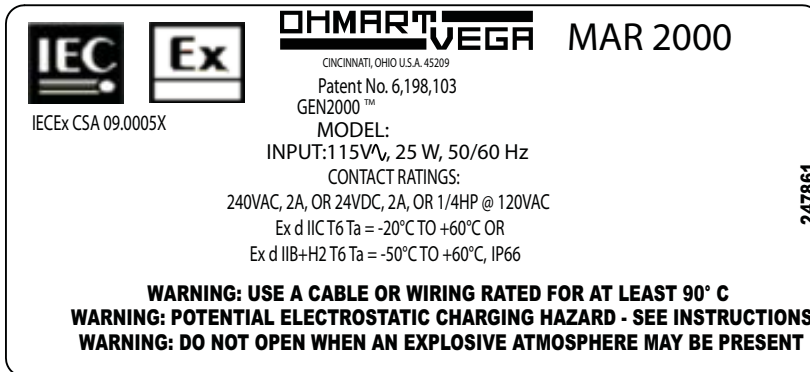


Figure 3: IECex Label

LFXG-H specifications

Table 3: LFXG-H specifications

System Accuracy	±1% of span typical	Accuracy depends on specific application parameters
Active Lengths	Flexible detector	305–7,010mm (12–276") in 305mm (12") increments
Typical Sources	Cesium-137	0.66MeV gamma radiation emitter, 30.2 year half life
	Cobalt-60	1.2 & 1.3MeV gamma radiation emitter, 5.3 year half life
Power Requirements*	AC	100–230 ±10% VAC (90–250VAC) at 50/60 Hz, at 15VA maximum power consumption (25VA max with heater) CE compliance requires 100–230 ±10% VAC
	DC	20–60VDC (less than 100mV, 1/1,000 Hz ripple) at 15VA CE compliance requires 24VDC±10%
	Wiring	1.63–0.643mm (#14–22AWG)
Signal Cable	Maximum length	1,000 m (3,280ft)
	HART signal	1.02–0.643mm (#18–22 AWG) two conductor shielded
GEN2000™ Electronics Housing	4-wire hookup with DC	1.02–0.643mm (#18–22 AWG) four conductor shielded
	Certification to CSA and UL standards	<ul style="list-style-type: none"> •Designed to meet National Electric Code (U.S. & Canada) •Class I, Groups A, B, C & D, Div 1 & 2 •Class II, Groups E, F & G, Div 1 & 2
	CENELEC certification	EExd IIC T5 (pending)
	Enclosure rating	NEMA 4X IP-66
	Ambient temperature	–20 °C ... –60 °C (–4 °F ... 140 °F) option for lower temperatures available
	Humidity	0–95%, non-condensing
	Vibration	Tested to IEC 68-2-6, IEC 68-2-27, and IEC 68-2-36
	Material	Cast aluminum ASTM A 357
	Paint	Polyester Powder Coating
Weight	Housing detector	0.0015xLength(mm)+5.44kg (0.084xLength(inches)+12lb)
Current Loop Output	Rating	4 ... 20 mA, isolated, into 250–800Ω
	Power	Jumper selectable: source (active) or sink (passive) mode.
Relay Output	Software user-settable	Diagnostic alarm or process high/low alarm function
	Rating	6A at 240VAC, or 6A 24VDC (SPDT Form C), or 1/4HP at 120VAC
HART® Communication	HART Protocol	BEL202 FSK standard current loop output
	PC interface	HART modem and VEGA communications software package
	Optional hand-held interface	HART Communicator model 275 hand-held terminal with VEGA device descriptions loaded
Auxiliary Input Capability	Type	Frequency input (0/100 kHz)
	Possible function	Optional NORM or vapor phase compensation, multiple gauge linking, & others
Electronics	On-board memory	FLASH and two EEPROMs
	Real-time clock	Maintains time, date, source decay compensation, and is Y2K compatible
Diagnostics	LED indication	+6V, Memory Corruption, HART, CPU Active, Auxiliary, High Voltage, Relay & Field Strength

* Power specifications change to 115VAC or 230VAC if an internal heater kit is used. For more information, see page 162.

Typical applications

VEGA level gauges accurately indicate the level of liquids or bulk materials throughout a range on vessels, reactors, or tanks.

In order to achieve a level indication over the desired length, it may be necessary to use more than one detector. The manner in which these multiple detectors link together depends upon the types of detectors used. Specific details on using multiple detectors are available in “Appendix II: Special Applications”.

The accuracy of quality control systems that use VEGA nuclear level gauges is profitable to a wide range of industry operations. A number of applications that use a level gauge are:

Pulp and Paper

- Liquors
- Bleach plant chemicals
- Coating chemical storage
- Lime mud
- Wastewater treatment tanks

Chemical

- Low pressure/low vapor chemical storage
- Settlers
- Surge tanks

Food and beverage

- Food slurries
- Pastes
- Syrups
- Dough level
- Intermediate batch storage

Water and wastewater

- Settling/aeration tanks
- Clarifiers
- Sludge holding tanks
- Wet wells

Where to find help

If you need help finding information, check the Index and Table of Contents within this manual. In addition, the gauge has “Help” screens that you can view using the universal hand-held terminal, VEGA View™, or Ohmview 2000™ software. These help screens are useful references for definitions of parameters and hints.

VEGA Customer Service

VEGA Customer Service has Field Service Engineers located across the U.S. for on-site service to U.S. and Canada. In many cases, a Field Service Engineer is at your plant for the start up of your gauge. In addition, Field Service Engineers regularly assist customers over the phone.

If you have a question or need help, call Customer Service during office hours. If your problem is an emergency (for example, line shut down because of VEGA equipment), you can reach us 24-hours a day.

Table 4: Contact information

VEGA Phone	513-272-0131
VEGA FAX	513-272-0133

In addition, VEGA provides field service for customers outside the U.S. and Canada. Customers outside the U.S. and Canada can also contact their local VEGA representative for parts and service.

When calling with a question, if possible, please have the following information ready:

- VEGA Customer Order (C.O.) Number—Locate on the engraved label on the source holder
- Sensor serial number—Locate on the sensor housing inside the external housing

Principle of operation

VEGA's continuous level gauge is a nuclear gauge that receives a shaped or collimated beam of radiation, through the process material, from the source holder. The material in the vessel acts as a shield that prevents a portion of the detector from exposure to the radiation field. As the level decreases, the detector senses more radiation. As the level increases, the detector senses less radiation.

Calibration of the level gauge associates the detector readings, known as counts, with the level of the material in engineering units. The output range of the gauge is a 4 ... 20 mA current loop signal, in proportion to the level of the process. See "Appendix I," for examples of process value settings.

System overview

The LFXG-H flexible detector uses VEGA's GEN2000® electronics. The GEN2000 is VEGA's newest compact electronics that support 4 ... 20 mA HART® protocol, frequency, or field bus output. The level measurement system consists of three main components:

1. Source holder
2. FiberFlex® flexible detector assembly LFXG-H
3. Communication device (HART modem with PC or HART Communicator model 275)

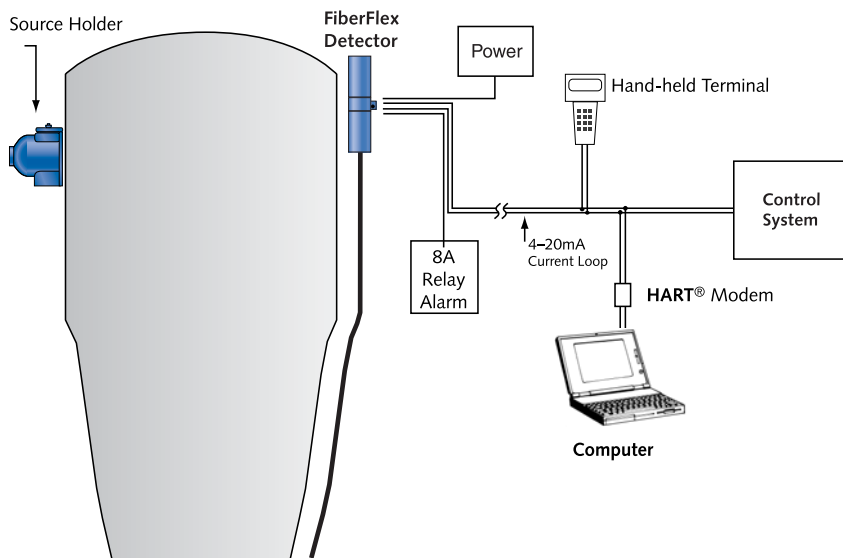


Figure 4: System overview

The following statements describe the source holder:

- A cast or welded steel device that houses a radiation-emitting source capsule
- Directs the radiation in a narrow collimated beam through the process vessel
- Shields the radiation elsewhere
- The model chosen for each particular system depends on the source capsule inside and the radiation specification requirements
- A shutter on the source holder either completely shields the radiation (source off) or allows it to pass through the process (source on)

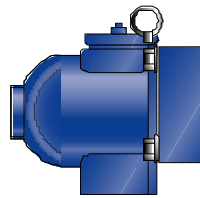


Figure 5: Typical source holder

Scintillator model LFXG-H

The following statements describe the functions of the FiberFlex flexible detector assembly (model LFXG-H):

- Mounts opposite the source holder
- Inside the flexible detector is a scintillation material
- The scintillation material produces light in proportion to the intensity of its exposure to radiation
- A photomultiplier tube detects the scintillator's light and converts it into voltage pulses
- The microprocessor receives these voltage pulses after amplification and conditioning by the photomultiplier tube
- The microprocessor and associated electronics convert the pulses into a calibratable output

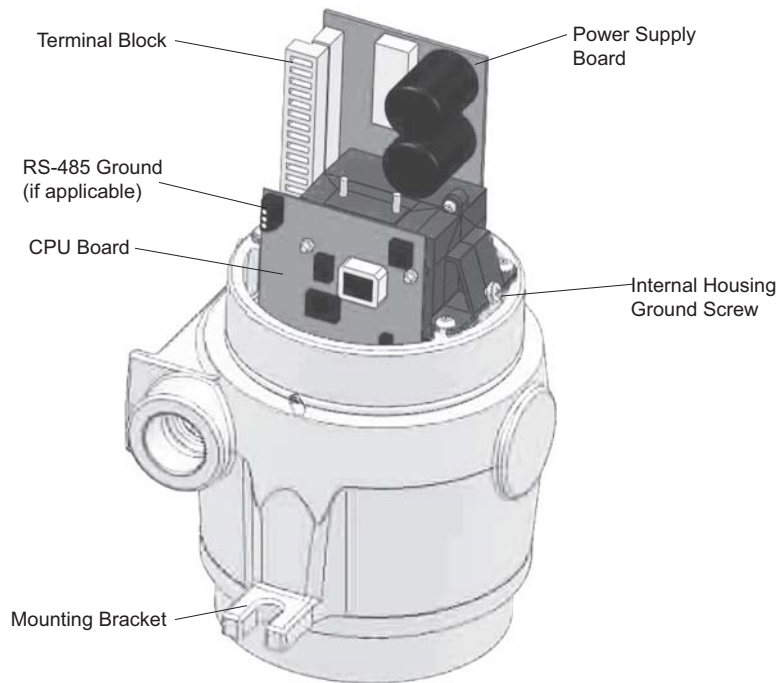


Figure 6: LFXG-H exploded view

Communicating with the gauge

The VEGA continuous level gauge is a transmitter, so it produces the current loop signal directly at the measurement site.

Use either a HART Communicator or HART modem and VEGA View or Ohmview 2000 software with a PC to enable the following:

- Initial setup
- Calibration
- Other communication with the gauge

You can make a connection anywhere along the 4 ... 20 mA current-loop line. After setup and calibration of the level gauge, there are no day-to-day requirements for external electronics.

Using a universal hand-held terminal

VEGA's LFXG-H level gauge is compatible with the Fisher-Rosemount HART Communicator. The HART (Highway Addressable Remote Transducer) Communicator uses the Bell 202 Frequency Shift Keying technique to superimpose high frequency digital communication signals on the standard 4 ... 20 mA current loop. To function, the minimum load resistance on the 4 ... 20 mA loop must be 250ohms (Ω).

Refer to the instruction manual for your HART Communicator for information on the following:

- Key usage
- Data entry
- Equipment interface

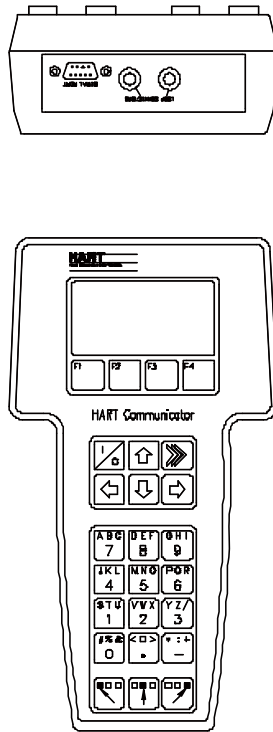


Figure 7: HART hand-held communicator

In order to effectively use the features in VEGA's level gauge, you must use VEGA's device description (DD) to program the HART communicator. You may purchase a universal hand-held terminal, programmed with the device, through VEGA (VEGA part number 236907).

Use firmware 2000.00 or higher when you use the hand-held HART communicator to make NORM or vapor compensation. See "Appendix II: Special Applications" for further information concerning NORM and vapor compensation.

Using VEGA View software on a PC

When you use an IBM-compatible personal computer to communicate with the LFXG-H, or other VEGA HART transmitter field device, you must have a HART modem and VEGA View software. The VEGA View software kit, part number 237857, includes the following:

- Modem
- Cables
- Software
- Manual

VEGA View software is a DOS program that emulates the HART Communicator Model 275. In addition, VEGA View enables the following:

- Charts the 4 ... 20mA current output graphically
- Stores and retrieves configuration data to disk
- Off-line editing of configurations

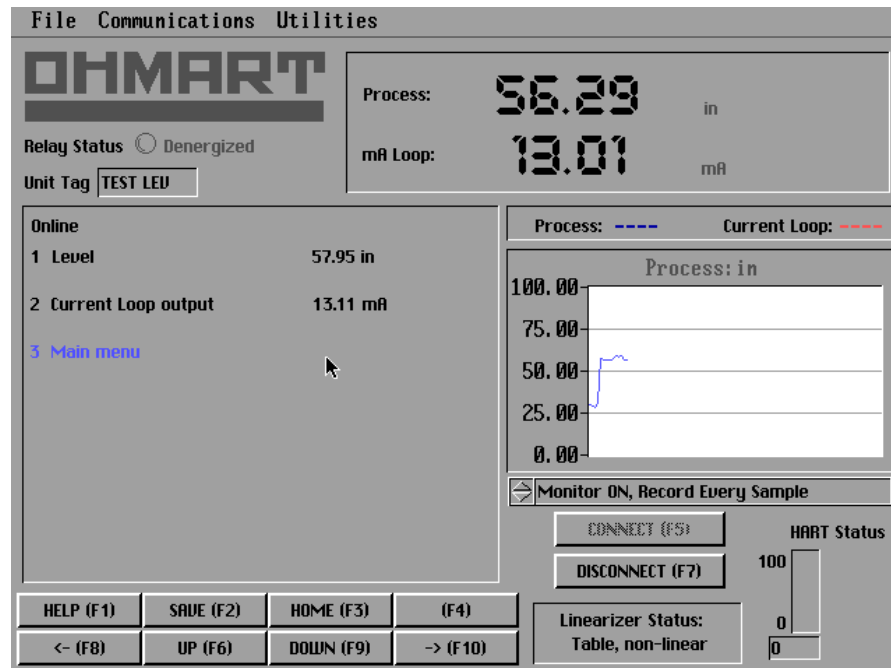


Figure 8: VEGA View software

Note: There are some minor differences in operation of the VEGA View software and the hand-held communicator. Most significantly, VEGA View software writes entries immediately to the level transmitter, but a communicator only sends changes after pressing F2 to send.

This manual's instructions are for the hand-held communicator, but most procedures use exactly the same steps.

Refer to the *VEGA View User Manual* that accompanies the software diskette for complete instructions for using VEGA View software.

Using Ohmview 2000 Software on a PC

When you use an IBM-compatible personal computer with windows and a Pentium processor to communicate with the DSGH, or other VEGA HART transmitter field devices, you must have a HART modem and Ohmview 2000 software. The Ohmview 2000 software kit, part number 243008, includes the following:

- Modem
- Cables
- Software

Ohmview 2000, RS-485 Network, Ohmview 2000 Logger, and Ohmview 2000 Configurator software is a window's program that emulates the HART Communicator Model 275. In addition, Ohmview 2000 enables the following:

- Charts the 4 ... 20mA current output graphically
- Stores and retrieves configuration data to disk
- Off-line editing of configurations

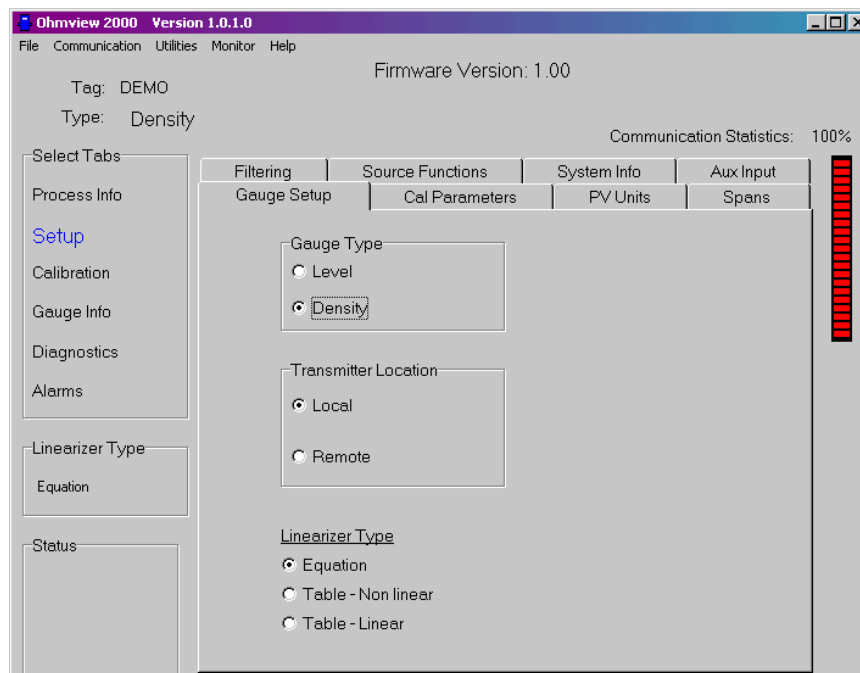


Figure 9: Ohmview 2000 software

Note: There are some minor differences in operation of the Ohmview 2000 software and the hand-held communicator. Most significantly, Ohmview 2000 software writes entries immediately to the transmitter, but a communicator only sends changes after pressing F2 to send.

This manual's instructions are for the hand-held communicator, but most procedures use exactly the same steps.

Introduction

Refer to the *Ohmview 2000 Electronic User Manual* that accompanies the software diskette for complete instructions for using Ohmview 2000 software.

The Ohmview 2000 software includes the main Ohmview 2000 software, HART Communication Server, Launcher program, Ohmview 2000 Logger, Ohmview 2000 File Configurator, and the Ohmview 2000 Electronic User Manual. When you insert the disk into your CD drive, the program automatically starts installing these programs onto your hard drive. The HART Communication Server must always be on when using Ohmview 2000's main program and Ohmview 2000 Logger.



Figure 10: Example of an Ohmview 2000 CD label

The HART screens menu structure

In both the hand-held HART Communicator and the VEGA View or Ohmview 2000 software, the user-interface for HART functions is in a menu structure. When the HART Communicator, or VEGA View, Ohmview 2000 starts up, the **Online** menu displays.

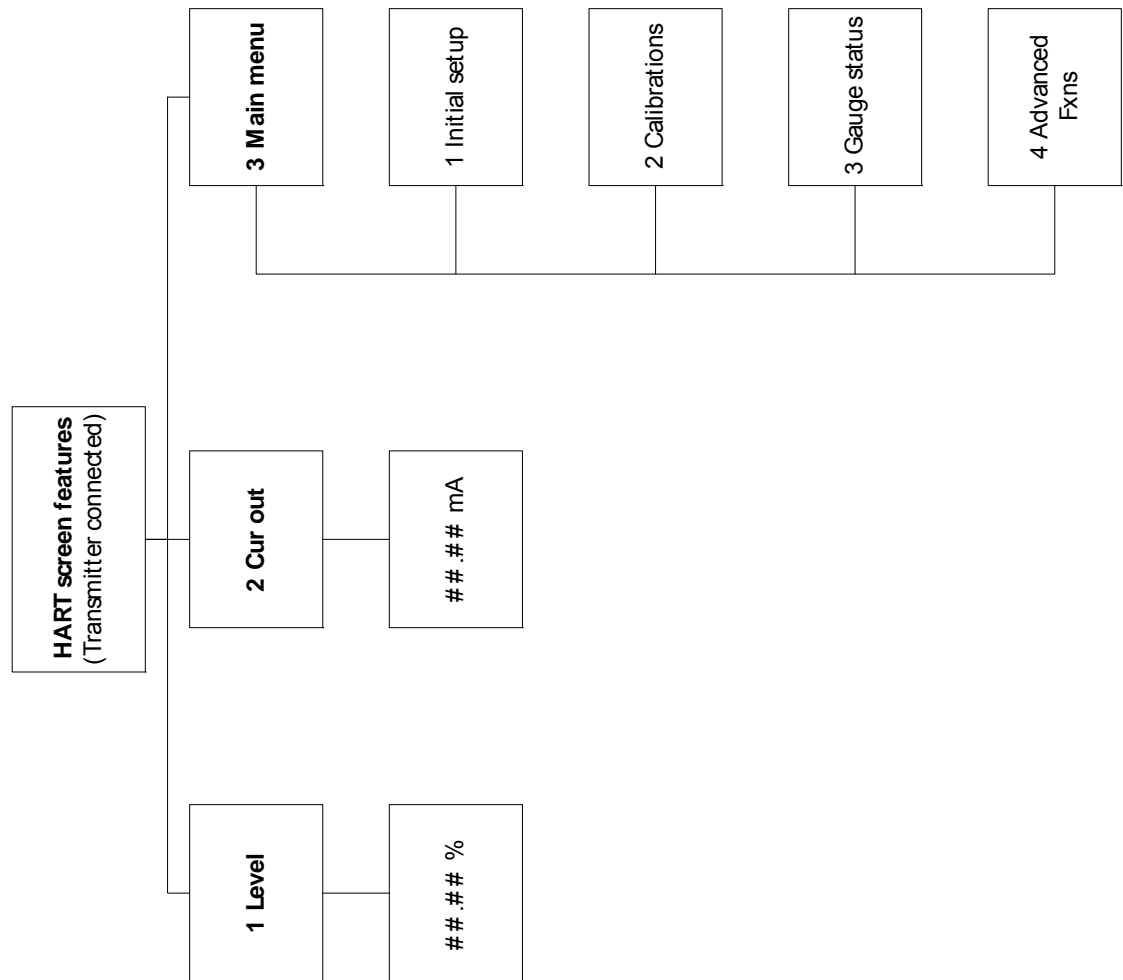


Figure 11: Online menu

For a detailed list of HART screen sub-menus, see "Appendix IV" of this manual.

Notes

Chapter 2: Installation

Testing on the bench

To ensure a quick start up after installation, you can test the detector assembly with the HART compatible communication device (either a universal hand-held terminal or a personal computer with a HART modem and VEGA software). Bench testing enables you to check the following:

- Power
- Communication
- Initial setup software parameters
- Some diagnostics

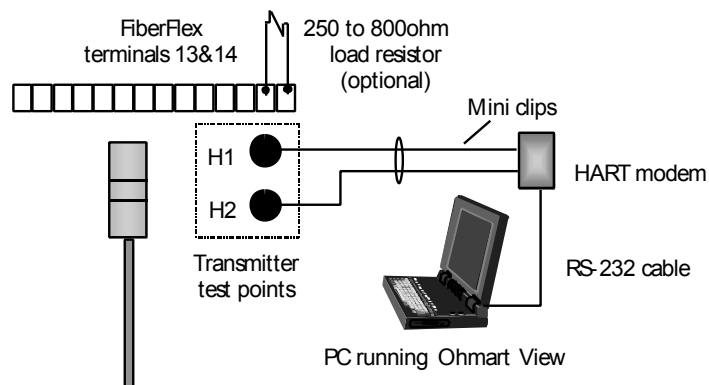


Figure 12: Bench test setup

Note: You may need to reset the time and date if the transmitter has not had power for over 28 days. The Real Time Clock Fail message may display. It is important to enter the correct time and date, because the clock is the basis for source decay calculations. For instructions to set the time and date, see page 106.

Many users choose to calibrate the current loop output “on the bench” before mounting the detector on the process. Refer to page 33 for further information on calibration of the current loop.

Location considerations

At the time you ordered the level transmitter, VEGA sized the source for optimal performance. Notify VEGA prior to installation of the gauge if the location of the gauge is different from the original order location. Proper location of the level gauge can sometimes mean the difference between satisfactory and unsatisfactory operation.



Note: Try to locate the source holder in such a place that process material will not coat it. This ensures the continuing proper operation of the source ON/OFF mechanism. Many regulatory agencies (for example, the U.S. NRC) require periodic testing of the ON/OFF mechanism. Refer to the “Radiation Safety for U.S. General and Specific Licensees, Canadian, and International Users” manual and the “Radiation Safety Manual Addendum of Reference Information” CD that came with the source holder and the appropriate current regulations for details.

Stable temperature

Mount the level gauge on a portion of the line where the temperature of the process material is relatively stable. Process temperature can effect the gauge indication. The amount of the effect depends upon the following:

- Sensitivity of the gauge
- Temperature coefficient of the process material

Protect insulation

If insulation is between the measuring assembly and the process, protect the insulation from liquids. The absorption of a liquid, such as water, can affect the gauge indication because it blocks some radiation.

Avoid internal obstructions

The best possible installation of a nuclear level gauge is on a vessel that has no internal obstructions (agitator, baffle, manways, and so forth) directly in the path of the radiation beam. If one of these obstructions is present, it can shield the radiation from the detector, causing an erroneous reading. If the vessel has a central agitator, the source holder and detector can mount to the vessel on an arc other than a diameter, so that the beam of radiation does not cross the agitator. You can also avoid other obstructions this way.

Avoid external obstructions

Any material in the path of the radiation can affect the measurement. Some materials that are present when the gauge initially calibrates pose no problem because the calibration accounts for their effect. Examples of these materials are:

- Tank walls
- Liners
- Insulation

However, when the materials change or you introduce new ones, the gauge reading can be erroneous.

Examples of these situations are:

- Insulation that you add after calibration absorbs the radiation and causes the gauge to erroneously read upscale.
- Rapidly changing tank conditions due to material buildup. Regular standardizations compensate for slowly changing tank conditions due to material buildup. See the “Calibration” chapter for information on standardization.

Avoid source cross-talk

When multiple adjacent pipes or vessels have nuclear gauges, you must consider the orientation of the source beams so that each detector senses radiation only from its appropriate source. The best orientation, in this case, is for the source holders to be on the inside with radiation beams pointing away from each other.

Mounting the measuring assembly

There are two types of mounting options. The first type is the bracket mount. The L bracket supports the electronics housing. For this type of mounting, the conduit clamps should be spaced every 18”.

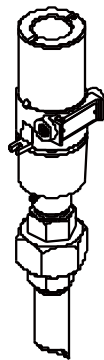
The second type of mounting is the conduit mount. This type of mount consists of an adapter with a 2” conduit coupler (part number 240721). It provides an air hose fitting for applications that need to cool the detector. The pole mount requires a nipple and union. Figure 13 illustrates the two mounting types.

Note: The detector active area (where it is possible to make a level measurement) is between 1” from the bottom of the detector to the end of the flexible conduit. Mount the detector so that this area spans the desired measurement length.



Note: On most source holders, the handle operates a rotating shutter. When installing or removing the assembly from the pipe, you must turn the handle to the closed or OFF position and lock the handle with the combination lock that VEGA provides.

Conduit mounting



Bracket mounting

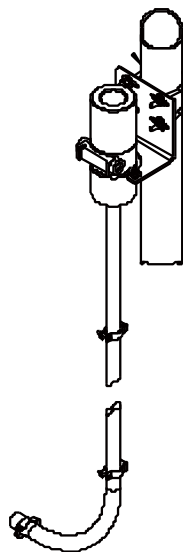


Figure 13: Conduit and bracket mounting

Wiring the equipment

Note: You may have received an interconnect drawing from VEGA or the engineering contractor. If the instructions on the drawing differ from the instructions in this manual, use the drawing. It may contain special instructions specific to your order.

Use the drawing notes and the steps that follow to make the input and output connections. Make the connections at the removable terminal strips mounted on the CPU board. Access the CPU board by removing the explosion-proof housing cap.

VEGA provides an internal and external ground screw for connection of the power Earth ground wire. After removing the top cover, the location of the internal ground screw is at the front of the housing. The location of the external ground screw is next to the conduit entry.

Note: Not all connections are required for operation. See Table 5: Terminal names and descriptions.

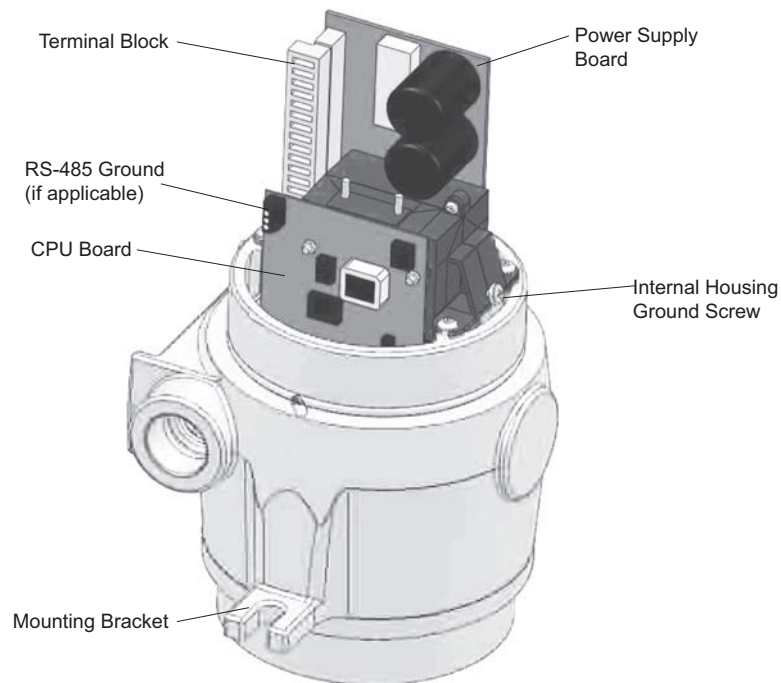


Figure 14: LFXG-H internal and external ground screw

LFXG-H

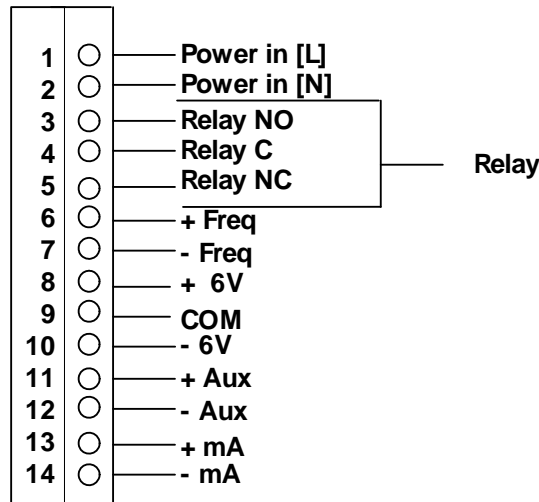


Figure 15: Interconnect

Table 5: Terminal names and descriptions

Terminal	Name	Description
1	L1	AC or DC power input
2	L2	AC or DC power input
3	RY NO	Relay normally open
4	RY C	Relay common
5	RY NC	Relay normally closed
6	Freq+	Not used in HART applications
7	Freq-	Not used in HART applications
8	+6	Auxiliary input power
9	COM	Auxiliary input power common
10	-6	Auxiliary input power
11	Aux+	Auxiliary input frequency signal
12	Aux-	Auxiliary input frequency signal
13	mA+	Positive current loop output
14	mA-	Negative current loop output

Note: The power input terminals are not polarity sensitive.

Power

**CAUTION!**

DO NOT APPLY POWER until a thorough check of all the wiring is complete!

The AC power source voltage input is 100–230VAC \pm 10% (90–250VAC) at 50/60 Hz, at 15VA (without heater) or 25VA (with optional heater) maximum power consumption. AC power must not be shared with transient producing loads.

The DC power source voltage input is 20–60VDC (less than 100mV, 1/1,000 Hz ripple) at 15VA maximum power consumption. DC power cable can be part of a single cable 4-wire hookup, or can be separate from output signal cable. (See "Output current loop " section)

Use wire between 1.63 to 0.643mm (#14 –#22AWG) for power wiring.

Switch for CE compliance

For CE compliance, install a power line switch no more than one meter from the operator control station.

Output current loop

Output signal is 4 ... 20 mA into 250–800ohms (Ω). HART communication protocol (BEL202 FSK standard) is available on these connections. The output is isolated to standard ISA 50.1 Type 4 Class U.

When using signal (current loop or 4 ... 20 mA output) cables that VEGA did not supply, the cables should meet the following specifications:

- Maximum cable length is 1,000m (3,280ft)
- All wires should be 1.02–0.643mm (#18 or #22AWG)

If using DC power, signal and power can run on a single cable 4-wire hookup (two wires for power, two for 4 ... 20 mA).

Communication

The HART hand-held terminal can connect anywhere across the 4 ... 20 mA wires to communicate with the level transmitter. A minimum requirement is a 250 Ω load-resistance on the current loop. The hand-held terminal is Rosemount model 275 or equivalent (VEGA number 236907).

A HART modem may also connect across the 4 ... 20 mA wires to enable communication between the level transmitter and an IBM compatible PC.

Process alarm override switch

If the output relay is set as a process alarm relay (high or low-level alarm), you can install an override switch to manually deactivate the alarm. If you do not install an override switch, the process alarm relay de-energizes only when the measured level is out of the alarm condition. The function of the output relay is set in the **Alarms** screen from the **Initial Setup** menu.

Conduit

Conduit runs must be continuous and you must provide protection to prevent conduit moisture condensation from dripping into any of the housings or junction boxes. Use sealant in the conduit, or arrange the runs so that they are below the entries to the housings and use weep holes where permitted.

You must use a conduit seal-off in the proximity of the housing when the location is in a hazardous area. Requirements for the actual distance must be in accordance with local code.

If you use only one conduit hub, plug the other conduit hub to prevent the entry of dirt and moisture.

Commissioning the gauge

The process of commissioning the gauge includes the following:

- Taking appropriate radiation field tests
- Checking the pre-programmed setup parameters
- Calibrating on process
- Verifying the working of the gauge.

VEGA Field Service Engineers typically commission the gauge. It is necessary to remove the source holder lock the first time the gauge takes measurements in the field. Only persons with a specific license from the U.S. NRC, Agreement State, or other appropriate nuclear regulatory body may remove the source holder lock.



Note: Users outside the U.S. must comply with the appropriate nuclear regulatory body regulations in matters pertaining to licensing and handling the equipment.

Can you remove the source holder lock?

If you are in doubt whether you have permission to remove the source holder lock...Do not!

The license sets limits on what the user can do with the gauge. Licenses fall into two categories:

1. General
2. Specific

Installation

It is up to the user to review the license to determine if they have the appropriate permission to perform any of the following:

- Disassemble
- Install
- Relocate
- Repair
- Test
- Unlock



Note: Low activity source holders have different requirements from a typical source holder. Contact VEGA Americas, Inc. for information regarding low activity source holders..

You can remove the source lock if installation of the gauge is in the U.S. and you have the specific license to remove the source holder lock. Confirm that your license specifically states that you have the permission to perform this operation and then contact VEGA Field Service Radiation Safety for the combination.

Do not remove the lock if the gauge has a general license tag, installation is in the U.S., and you do not have the specific license that gives you permission to remove the lock. You can verify whether the gauge is a general license gauge by checking the source holder for the general license tag. If it is not there, it is not a general license device.

If you do not have permission to remove the source holder lock, an VEGA Field Service Engineer or another person with this specific license must remove it for you.

Field service commissioning call checklist

In many U.S. installations, an VEGA Field Service Engineer commissions the gauge. To reduce service time and costs, use this checklist to ensure the gauge is ready for commission before the Field Service Engineer arrives:

- ☑ Mount the source holder and detector per the certified drawings found in the custom information folder in this manual, allowing access for future maintenance
- ☑ Make all wiring connections per the certified drawings and the “Wiring the Equipment” section in this manual. Tie in the wiring from the field transmitter analog output to the DCS/PLC/chart recorder
- ☑ Ensure that the AC power to the transmitter is a regulated transient-free power source. UPS type power is the best
- ☑ If using DC power, verify that the ripple is less than 100mV

Note: The equipment warranty is void if there is damage to the gauge due to incorrect wiring not checked by the VEGA Field Service Engineer.

- ☑ Have process ready for calibration
- ☑ When possible, it is best to have process available near both the low and high end of the measurement span
- ☑ When possible, it is best to be able to completely fill and empty the vessel, at the high and low levels for the initial calibration procedure, and when possible at 10% increments in between for the linearization procedure
- ☑ Do not remove the lock on the source holder. Notify VEGA Field Service if there is damage to the lock or it is missing.

Chapter 3: Calibration

All of these functions group together in the **Calibrations** screens. See “Appendix IV” of this manual for **Calibrations** menus and screens.

Before using the level transmitter to make measurements, you must perform the following:

- Calibrate it to relate the detection of radiation from the source to the level of the process material
- Calibrate the current loop to a reference ammeter or the DCS
- Periodically, you must standardize the system on process to adjust for changes over time

Calibration establishes a reference point or points that relate the detector output to actual (or known) values of the process.

You must perform a calibration before the gauge can make measurements of any accuracy. Perform the calibration after the installation and commission of the gauge at the actual field site.

You do not need to repeat the calibration procedures as long as certain critical process and equipment conditions remain the same. See “When a New Calibration May Be Necessary” in this manual. The gauge requires only a periodic standardization to compensate for changing conditions.

Current loop (analog output) calibration

Calibrating the current loop adjusts the 4 ... 20 mA output to a reference—either the PLC/DCS or a certified ammeter. It forces the 4 and 20 mA outputs to the external reference. The VEGA factory pre-adjusts the current loop with a certified ammeter, so it is very close to the outputs required.

To correlate the 4 ... 20 mA to the process value, set the span of the current loop output in the **Loop Span** screen from the **Initial setup**, **Process parameters**, **Spans**, **Current Loops Span** menu. See the “Appendix I, Initial Factory Setup” section for details.

Note: The current loop and process spans are independent and set separately. The current loop span sets the level indications for the 4 and the 20 mA outputs. The process span sets the endpoints of the calibration curve. The current loop span and process span are set in the **Initial setup** screen from the **Main menu**.

A quick way to check the span settings is to use the **View settings** menu from the **Initial setup** menu.

A direct measurement of the current is preferable. Take this measurement by hooking the meter up in series with the instrument and the DCS. However, if you know the resistance of the DCS, use a voltage measurement to calculate the current.

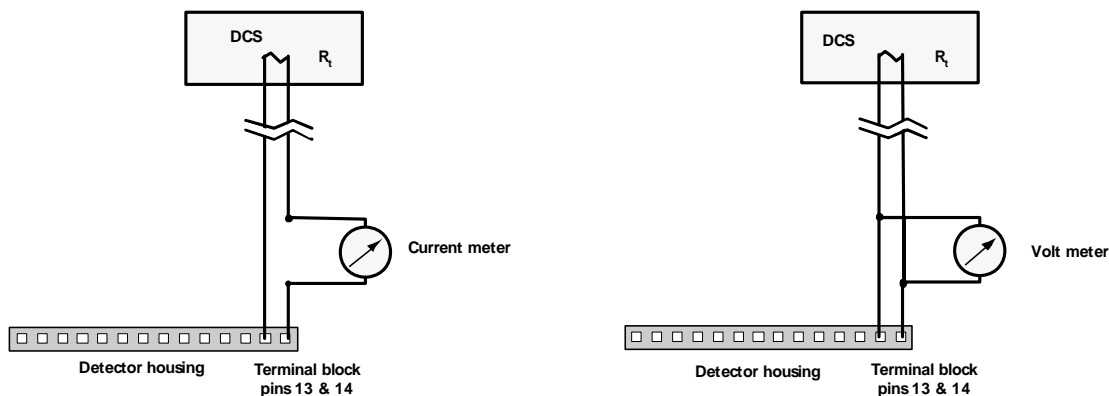


Figure 16: Measuring the current loop output

Before a current loop calibration:

- ☑ Connect an ammeter or the DCS to terminal connections 13 (mA +) and 14 (mA -), or the test points H1 and H2, or anywhere along the current loop
- ☑ Make sure there is a 250–800 Ω load on the current loop. If no load or an insufficient load exists on the loop, it may require temporary placement of a resistor across terminals 13 and 14. Hook the meter or DCS in series with the load resistor.

Calibrating the current loop

Procedure 1: Calibrating the current loop

1. From **Calibrations** menu, select **Current loop cal**
2. The Current loop cal screen prompts you to connect the reference meter. Press F4 when the ammeter connects

The screen displays, Setting Field Device Output To 4 mA. The analog output circuit on the transmitter sets the current to approximately 4 mA
3. Read the ammeter and enter the actual milliamp reading
Note: If using a voltmeter, calculate the current value
4. The next screen prompts, Field Device Output 4.00 mA Equal to Reference Meter?
 - Choose **Yes** if the ammeter reads 4.00 mA
 - Choose **No** if the ammeter reads anything but 4.00 mA
5. Repeat until the meter reads 4.00 mA. The meter approaches the 4.00 mA successively
6. Repeat procedure for 20mA setting.

You can check the current loop output calibration at any time by using the test mode to output a user-specified milliamp setting. See the section “Milliamp Output Test Mode” in the manual.

Choosing the calibration method

For each installation, the user must choose one of two ways to calibrate the level transmitter. The best calibration method depends on how you use the continuous level transmitter. Read the following table to decide which method to use.

Table 6: Calibration methods

Standard method	Simple method
Use the standard method if...the gauge is required to be repeatable and accurately indicate the level of process throughout the span.	Use the simple method if...the gauge is only required to be repeatable, but need not accurately indicate the level of process.
Typically used for vessels in which it is critical to know the accurate level.	Typically used for surge bins or other vessels under control that maintains one level.
The linearizer type chosen must be "Non-linear table"	The linearizer type chosen must be "Linear table"

Note: The simple calibration method produces a measurement indication that is repeatable but not accurate between the Cal Low Level and Cal High Level points. The measurement indication is not linear with respect to the actual process level.

In some applications, accuracy is not critical and this method is valid.

If your application requires a linear or accurate indication of the actual process level, you must use the standard method of calibration

Standard method of calibration

Figure 17 illustrates the steps to prepare for and perform a standard method calibration.

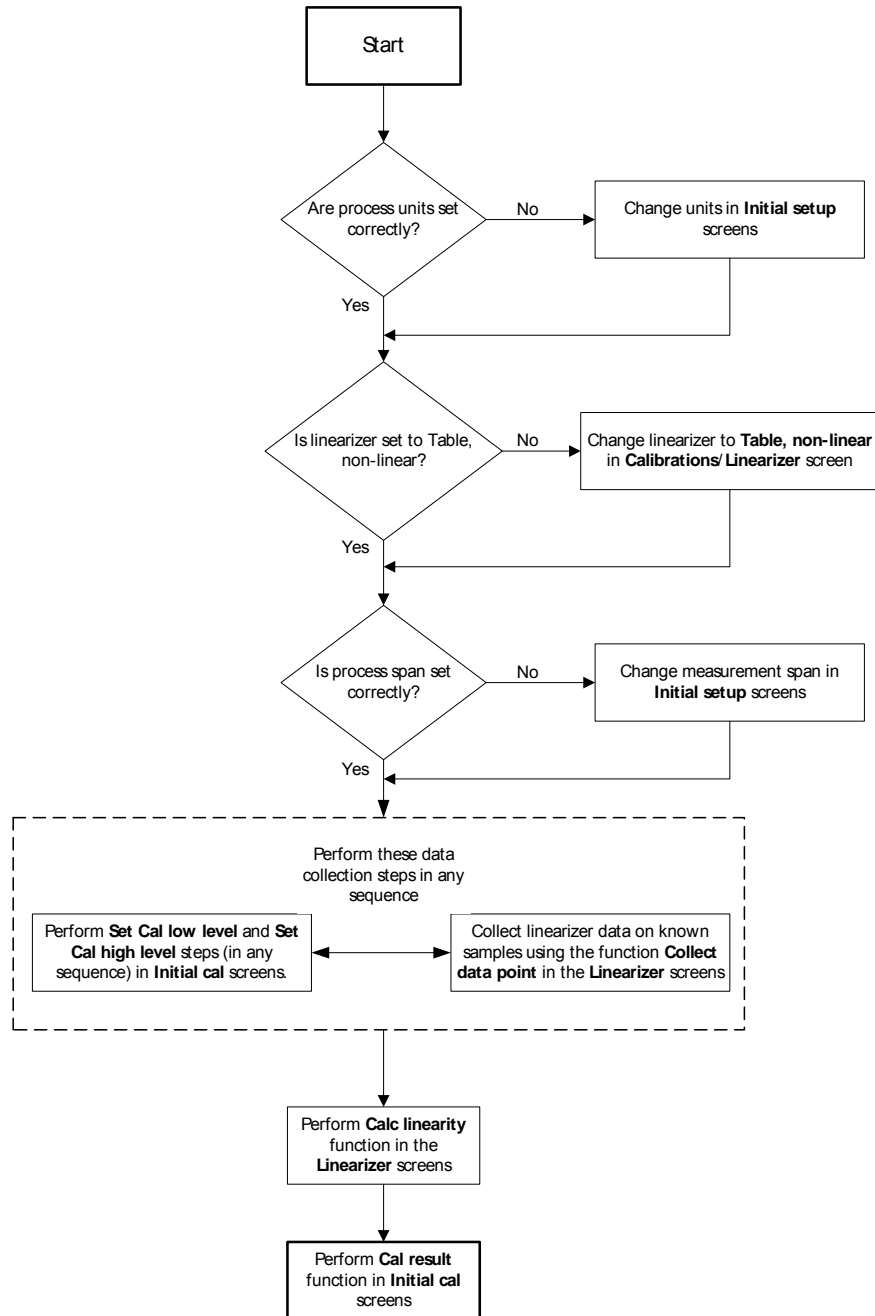


Figure 17: Standard method calibration flow chart

Table 7: Standard method calibration

Standard method calibration		
Step in flow chart	Manual heading	Page
Check process engineering units	Units	98
Check process span	Span settings, process span	103
Check linearizer type, set to table, non-linear	Choosing the linearizer type	38
Check the repeatability of measurement	Checking the gauge repeatability	43
Perform "Set Cal low level" and "Set Cal high level"	Step 1: Set low level Step 2: Set high level	46 47
Collect linearizer data on known samples	Step 3: Collecting linearizer table data	47
Perform "Calc linearity"	Step 4: Calculating the linearity	49
Perform "Cal result"	Step 5: Calculate calibration	49

Simple method of calibration

Figure 18 illustrates the steps to prepare for and perform a simple method calibration.

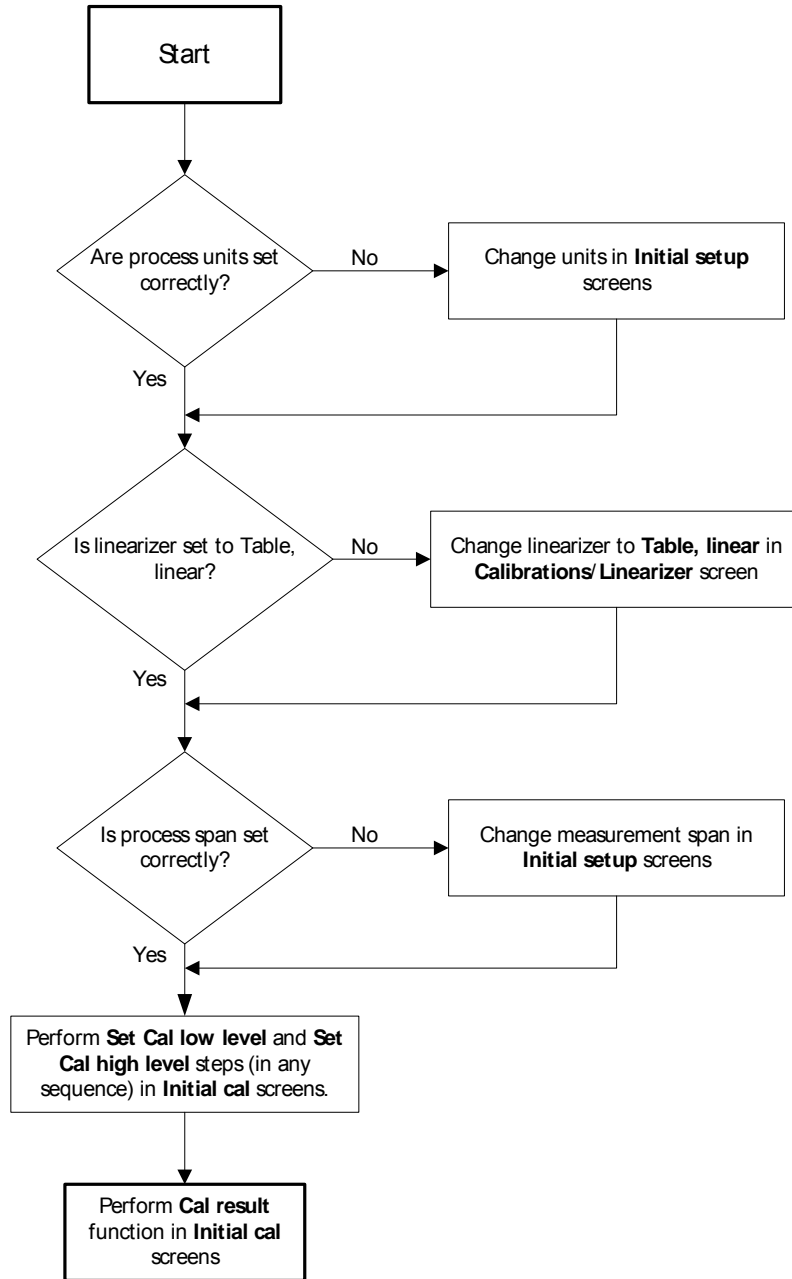


Figure 18: Simple method calibration flow chart

Table 8: Simple method calibration

Simple method calibration		
Step in flow chart	Manual heading	Page
Check process engineering units	Units	98
Check process span	Span settings, process span	103
Check linearizer type, set to linear table	Choosing the linearizer type	38
Check the repeatability of measurement	Checking the gauge repeatability	43
Perform "Set Cal low level" and "Set Cal high level"	Step 1: Set low level Step 2: Set high level	46 47
Perform "Cal result"	Step 5: Calculate calibration	49

Theory of calibration

This section explains both the standard and simple methods of calibration.

Both calibration methods

Enter the values that define the maximum and minimum levels to measure in the **Process span** screens, from the **Initial setup**, **Process parameters**, **Spans** menus. These parameters are Max Level and Min Level, and must be set correctly before any of the calibration steps.

Both calibration methods

Collection of data points nearest the Maximum (but not higher) and Minimum (but not lower) levels occurs during calibration. Refer to the “Two Point Cal” procedure in this manual for the steps necessary to collect these data points. In Figure 19, stars indicate the Maximum and minimum level data points.

Standard calibration method

A standard calibration method requires collection of intermediate data points. Use the **Linear data collect** function from the **Calibrations**, **Linearizer** menus to collect these data points. In Figure 19, circles indicate the intermediate data points.

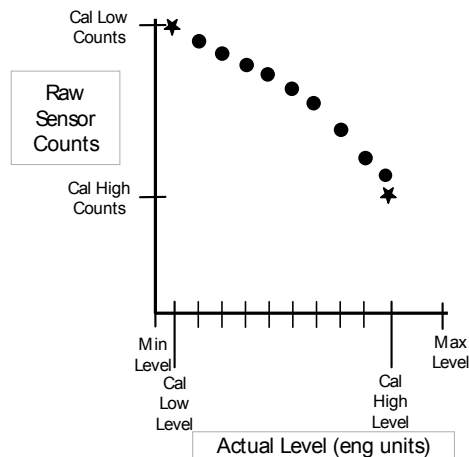


Figure 19: Linearizer data collected at various process levels

Simple calibration method

The simple method of calibration does not require collection of intermediate data points.

Standard calibration method

Internal software calculates a linearizer curve based on data points. The curve is the most accurate between the Cal Low Level and Cal High Level, as shown in Figure 20. For this reason, it is best to take the Cal Low and Cal High samples as close as possible to the Min Level and Max Level to maximize the accuracy within the span.

Simple calibration method

Based on the Cal Low Level and Cal High Level, the internal software calculates a straight line between the Min Level and Max Level.

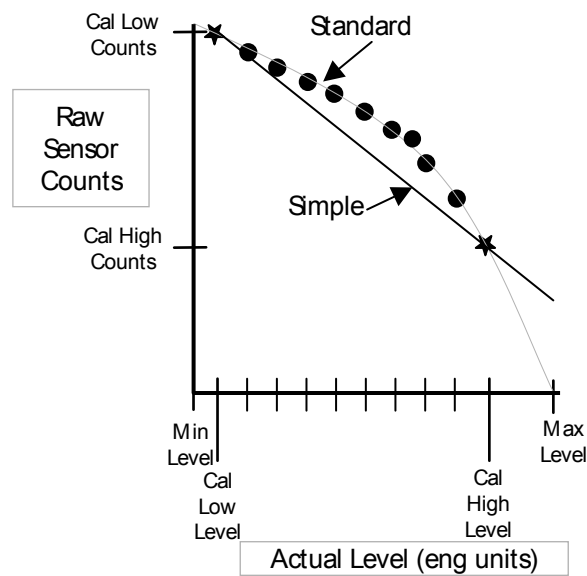


Figure 20: Raw counts vs. actual level with linearizers

Standard calibration method

The linearizer curve maps on two axes so that it indicates % Count Range vs. % Span, as shown in Figure 21. To construct the linearizer table, a data point calculates for every 2.5% of the span. View or edit these points in the Linearizer table screen.

Simple calibration method

The internal software calculates a straight line between the Min Level and Max Level based on the Cal Low Level and Cal High Level.

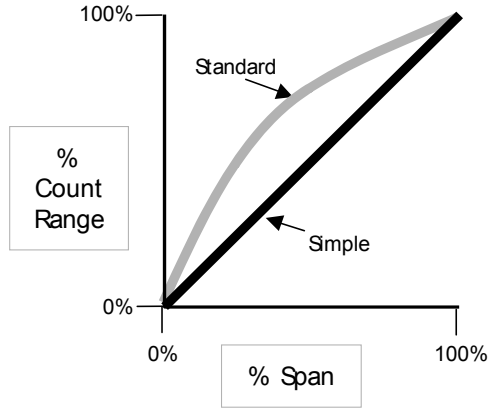


Figure 21: %Count range vs. %span (shown in linearizer table)

Both calibration methods

Figure 22 illustrates the effect on the final output of using the non-linear table vs. the linear table for the linearizer. Using the non-linear table linearizer in the standard method produces a linear output. Using the linear table linearizer table produces a non-linear output.

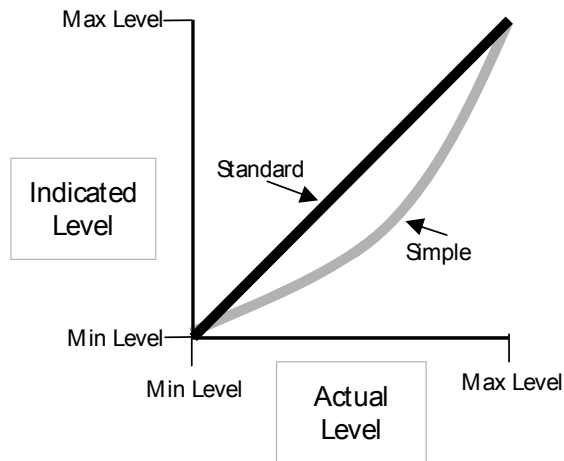


Figure 22: Indicated level vs. actual level

Choosing the linearizer type

The level transmitter response curve is non-linear, due to the measurement method of radiation transmission. The linearizer determines the shape of the curve between the endpoints.

As part of the signal processing necessary to produce a linear final output with respect to the change in level of process material, the level transmitter offers the following choices:

1. Non-linear table
2. Linear table

Non-linear table

Use this option for a standard method calibration. The non-linear table is more accurate than the linear table. This is because the non-linear table takes into account the inherent non-linearity of a nuclear transmission measurement. The non-linear table can use data from the following:

- Linearizer look up table, data points that you collect and enter during the calibration process
- Linearizer data from an earlier model VEGA level gauge

Table, linear

Use this option for a simple method calibration. This option enables you to use a linear (straight-line) set of data for a linearizer look up table. You do not need to collect linearizer table data points. The straight-line linearizer calculates from the high and low-level initial calibration points. This requires you to perform the following:

- Two-point calibration
- Calculate the calibration

This is not as accurate because it does not compensate for the non-linearity of a radiation transmission measurement.

Choosing a linearizer method

Procedure 2: Choosing a linearizer method

1. From the **Online** menu, select **Main menu**
2. From the **Main menu**, select **Calibrations**
3. From the **Calibrations** menu, select **Linearizer**
4. From the **Linearizer** menu, choose **Select linearizer**
5. On the **Select linearizer** screen, the currently used linearizer is displayed on the second line
6. From the **Select linearizer** screen, select either:
 - Table, non-linear
 - Table, linear
7. Press F4 to enter.

Refer to “Appendix III” for further instructions if you choose the Table, linear option.

Checking the gauge repeatability

Check the level transmitter measurement repeatability before performing the calibration.

Access the **Data collect** function in the **Data Collect** screen, from the **Calibrations** menu to enable simple measurement of the process, without altering the calibration or standardization values. It enables the system to measure the process and report the number of sensor counts. For more information about counts and the calculations performed to produce the final process value, see the “Process Chain” section in the “Advanced Functions” chapter.

You can perform a data collect three or four times on the same level to check the repeatability of the sensor. If the sensor counts vary widely, you should increase the Data collection interval parameter from the **Initial setup** menu, **Process parameters** menu, **Data coll interval** screen. Refer to page 99 for further information.

Performing a data collect

Procedure 3: Performing a data collect

1. From the **Main menu**, select **Calibrations**
2. From the **Calibrations** menu, select **Data collect**
3. At the prompt, select **Yes** to enable the data collection to take place. The on-screen counter displays the time left. Press F3 to abort if necessary to discontinue data collect
4. After data collection, the screen displays the number of counts (cnts) output by the sensor. Make note of the counts value
5. Repeat as often as necessary if checking repeatability.

Calibrating the gauge

The standard calibration method involves five main steps:

1. Setting the low level and collecting Cal low data*
2. Setting the high level and collecting Cal high data*
3. Collecting linearizer data*
4. Calculating the linearizer
5. Calculating the calibration

* Perform these data collection steps in any sequence. Your ability to empty and fill the vessel determines the best sequence.

The simple calibration method skips Step 3 and 4.

If using the standard calibration method, you may find it helpful to record the sensor counts and levels at each step on Table 9.

Table 9: Standard calibration sensor counts and levels record

Data type	Sensor counts	Actual level (eng units)
Cal low level (usually empty) Linearizer data point 0		
Linearizer data point 1		
Linearizer data point 2		
Linearizer data point 3		
Linearizer data point 4		
Linearizer data point 5		
Linearizer data point 6		
Linearizer data point 7		
Linearizer data point 8		
Linearizer data point 9		
Cal high level (usually full) and Linearizer data point 10		

Step 1: Set low level

Setting the low level for calibration requires the following activities

- Measurement with the level transmitter of the low process level
- Entry of the actual level

This sets the low end (sometimes referred to in the U.S. as “zero”) of the calibration curve. Perform this procedure either before or after setting the high level.

Note: You must perform data collection for the low and high level within ten days of each other for a good calibration. The low and high values must be more than 10 percent of the process span apart for the most accurate calibration.

Increasing the process span usually increases the gauge accuracy.

Before starting the cal low data collection:

- Fill vessel to its low level
- Have actual level value ready to enter

Setting the cal low level

Procedure 4: Setting the cal low level

1. From the **Main menu**, select **Calibrations**
2. From the **Calibrations** menu, select **Initial cal**
3. From the **Initial cal** menu, select **Two point cal**
4. From the **Two point cal** menu, select **Set Cal low level**
5. The prompt, Set process to desired value. Take data? displays. Select **Yes** to enable the data collection to take place. The on-screen counter displays the time left. If necessary, press F3 to discontinue data collection
6. After collection of the data, the screen prompts you to input the actual value. Input the actual value in engineering units
7. If using a hand-held Communicator, press F2 to send the calibration setting to the level gauge.

Step 2: Set high level

Setting the high level for calibration requires the following activities:

- Measurement with the level transmitter of the high process condition
- Entry of the actual level

This sets the “gain” of the calibration curve. Perform this procedure either before or after setting the low level.

Note: You must perform data collection for the low and high level within ten days of each other for a good calibration. The low and high values must be more than 10 percent of the process span apart for the most accurate calibration.

Increasing the process span usually increases the gauge accuracy.

Before starting the cal high data collection:

- Fill vessel or pipe with high process, or close the source holder shutter to simulate high process
- Have actual level ready to enter

Setting the cal high level

Procedure 5: Setting the cal high level

1. From the **Main menu**, select **Calibrations**
2. From the **Calibrations** menu, select **Initial cal**
3. From the **Initial cal** menu, select **Two point cal**
4. From the **Two point cal** menu, select **Set Cal high level**
5. The prompt, Set Process To High Calibration Point. Take Data? displays. Select **Yes** to allow the data collection to take place. The on-screen counter displays the time left. If necessary, press F3 to discontinue data collection
6. After data collection, the screen prompts you to input the actual value in engineering units. The prompt, Input Actual Value, displays. Enter the actual level in engineering units
7. If using a hand-held communicator, press F2 to send the calibration setting to the level transmitter.

Step 3: Collecting linearizer table data

Note: The simple method of initial calibration does not use this step.

This step allows you to collect data points between the high and the low calibration points so that the VEGA level transmitter calculates a response curve based on your data.

Note: VEGA View PC Software users: The linearizer data collection procedure is significantly different in VEGA View. Refer to the VEGA View User Manual for instructions to collect linearizer data.

Before collecting the linearizer table data:

- Prepare to set the level and take data. Ten levels (including the Cal low and Cal high levels) are the maximum
- Prepare to enter the levels into the transmitter
- You can collect linearizer table data along with the data collection for the Cal low and Cal high levels

Collecting linearizer table data

Procedure 6: Collecting linearizer table data

1. From the **Main menu**, select **Calibrations**
2. From the **Calibrations** menu, select **Linearizer**
3. From the **Linearizer** menu, select **Linearizer data**
4. From the **Linearizer data** menu, select **Linear data collect**
5. From **Linear data collect** menu, select **Collect datapoint**
6. At the prompt, enter the actual known level of process
7. Accept or reject the results when they display
8. Repeat procedure for all available levels
9. Press F2 to send.

Note: Include the data for the Cal low and Cal high with the linearizer data before you perform Calculate linearity. If you did not perform a linearizer data collect while the process was at the levels for Cal low and Cal high, you can manually add those values to the linearizer data.

To add a data point to the linearizer data, you must know the level in engineering units and the sensor counts. Go to the **Add new data pt** screen, from the **Calibration, Linearizer, Linearizer data, Linear data collect** menus, and follow the prompts to enter the data.

Step 4: Calculating the linearity

Note: The simple method of initial calibration does not use this step.

After collecting the data for a linearizer table, the transmitter uses the data to calculate a new calibration linearizer table. The **Calc linearity** function initiates this calculation. You must perform this step before the Calculate Calibration step, described in the next section.

Calculating a new linearizer table

Calculate the linearizer after you perform the following steps:

- Select non-linear table for the linearizer curve
- Collect linearizer data

Procedure 7: Calculating the linearizer

1. From the **Main menu**, select **Calibrations**
2. From the **Calibrations** menu, select **Linearizer**
3. From the **Linearizer** menu, select **Linearizer data**
4. From the **Linearizer data** menu, select **Linear data collect**
5. From the **Linear data collect** menu, select **Calc linearity**
6. At the prompt, select **Yes** to proceed with the linearity calculation. The linearizer table calculates based on the level values
7. Press F2 to save.

Step 5: Calculate calibration

After collecting the high and low level calibration data and calculating the linearity, the level transmitter is ready to make the calibration calculation.

Calculating the calibration result

Procedure 8: Calculating the calibration result

1. From the **Main menu**, select **Calibrations**
2. From the **Calibrations** menu, select **Initial cal**
3. From the **Initial cal** menu, select **Two point cal**
4. From the **Two point cal** menu, select **Cal result**
5. The screens display the results of the cal low and cal high sensor counts and values. Review the values. You can manually edit the counts and actual or new data can be collected by repeating the Set low and Set high procedures, or press F4 to continue
6. The prompt, Proceed with Calibration Calculation?, displays. Select **Yes** to proceed with the calculation
7. Press F2 to save.

When a new calibration may be necessary

Under most circumstances, you do not need to repeat the calibration procedure. The system requires only periodic standardization to compensate for drifts over time. However, certain events necessitate a new initial calibration. The events are:

- Measurement of a new process application (contact VEGA for recommendation)
- Process requires a new measurement span
- Entry of a new measurement span setting into the software
- Installation of a new radiation source holder
- Moving the level transmitter to another location (in U.S. only specifically licensed persons may relocate the gauge)
- Changes to the process vessel, for example: lining, insulation, or agitator
- Excessive build up or erosion of vessel that standardization cannot compensate for (check standardize gain)
- Standardize gain is greater than 1.2 after a standardization, indicating it made a 20% adjustment from the initial calibration

Periodic process standardization

Standardization adjusts the system by resetting one point of the calibration curve to an independently measured or known level.

The frequency of standardization depends on several factors, including desired accuracy of the reading.

During the standardization procedure, the system displays either:

- A default value for the standardization condition
- A prompt to enter the actual level of the standardization condition

The Initial factory setup appendix details how to set up the software for either prompt.

Automatic standardization reminder

If you enable the standardization due alarm, the level transmitter alarms when standardization is due. The standardize interval is programmed into the calibration parameters setup. Refer to “Appendix I, Initial Factory Setup”, for details on the following subjects:

- Output relay setup
- Standardization due alarm
- Standardization interval

Performing a standardization

Standardizing the gauge

Procedure 9: Standardizing the gauge

1. From the **Main menu**, select **Calibrations**
2. From the **Calibrations** menu, select **Process stdz**
3. The **Process stdz** screen prompts if you want to take data. Select **Yes** if you are ready with the standardization material in the process vessel to continue the standardization procedure. The timer counts down while it is collecting data
4. Depending on how the system is set up, it displays one of the following:
 - The message, Gage Set up to Use Default Value, indicates the system is using the default value as the actual value of the standardization material
 - A screen that displays the detector counts, the calculated process value, and a field for the user to input the actual value of the level. The prompt asks, Edit Counts? Select **No** to continue or **Yes** to input the average counts
5. Press F2 to send.

Chapter 4: Advanced functions

Functions not required for normal operation of the transmitter are found in the software menu structure under the heading, **Advanced Fxns**. These functions are primarily for use by VEGA personnel for advanced troubleshooting and repair. This chapter gives a basic explanation of these functions.

Note: VEGA strongly recommends that you ask our advice before using any of these advanced functions.

Process chain

The process chain is a description of the transmitter software's calculation of a level measurement from a radiation reading. In the **Process chain** screen, you can view intermediate values of the calculation to verify proper functionality of the software.

Primary channel

Press the hot spot key (>>>) on the hand-held communicator to display the **Primary channel** screen. The display values for the **Primary channel** screen are:

Temp

Temperature displays the internal probe's measurement of the sensor temperature.

Sensor cnts

Displays the sensor counts that are true counts output, from the sensor, before application of the following:

- Temperature compensation
- Standardize
- Sensor uniformity gains

TC counts

Displays temperature compensated counts that are sensor counts with application of temperature compensation.

Raw counts

Displays raw counts that are temperature compensated counts with application of uniformity gain.

Adj counts

Displays adjusted or sum counts that are raw counts plus auxiliary raw counts. In most applications, this does not use auxiliary input, so sum counts are equal to raw counts.

SD counts

Displays source decay counts that are sum counts with application of source decay gain.

Stdz counts

Displays standardize counts that are source decay counts with application of standardization gain.

% Cnt range

Displays compensated measurement counts that express as a percent of the counts at the high and low-endpoints of the calibration (determined with the two point initial calibration.) This quantity shows where the current measurement is in relation to the total count range.

$$\% \text{ count range} = 100 \times (C_L - C_S) / (C_L - C_H)$$

where

C_S = sum counts

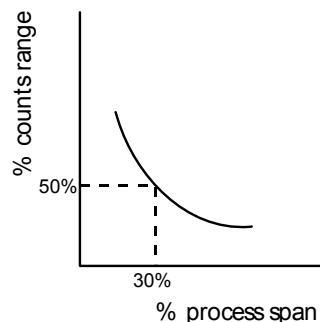
C_L, C_H = counts at Cal low level and Cal high level

$C_L - C_H$ = counts range

% of span

The percent process span indicates the measurement value as a percent of the measurement span. The maximum and minimum level values are input in the **Initial setup** screens. A graph of percent count range vs. percent process span indicates the non-linearity of the radiation transmission measurement. If using a table linearizer, the values in the table are percent count range and percent process span.

Figure 23: % counts range vs. % process span



Raw level

Raw level displays the level in inches without the time constant or rectangular window filter.

Uncomp Lvl

Uncompensated level displays the level in inches without the time constant or rectangular window filter.

Level

Level displays the process value that is the level or other indication in engineering units, after applying the filter. This value relates to the current loop output.

Process variables

The display values for the **Process variables** screen are:

Counts low

Displays the counts-low that is the temperature and sensor uniformity gain compensated counts from the sensor at the Cal low level. Determination of the Cal low level occurs during the initial calibration procedure.

Counts high

Displays the counts-high that is the temperature and sensor uniformity gain compensated counts from the sensor at the Cal high level. Determination of the Cal high level occurs during the initial calibration procedure.

Max level

Displays the maximum level that is the value, in process units, as entered in the **Initial setup** screens. Use this to calculate the measurement span.

Min level

Displays the minimum level that is the value, in process units, as entered in **Initial setup** screens. Use this to calculate the measurement span.

Temp comp gain

Temperature compensation gain displays the current value of the temperature compensation gain. Use this to adjust for inherent sensor output change with temperature.

Uniformity gain

Uniformity gain displays the current of the uniformity gain. Use this to force all level sensors to output the same counts at a given radiation field. Most level applications do not use uniformity gain and have it set as default value of 1.0.

Source decay gain

Source decay gain displays the current value of the source decay gain. Use this to compensate for the natural decay of the radiation source, which produces a lower field over time.

Stdz gain

Displays the current value of the standardize gain that adjusts with each standardize procedure.

HV setting

HV setting displays the HV setting feature that is the set point for sensor high voltage.

Aux channel chain

The display values for the **Aux channel chain** screen are:

Aux raw counts

The Auxiliary raw counts field displays the frequency-input counts from optional auxiliary input.

Filt counts

Filtered counts displays the filtered auxiliary counts. The filter dampening value is the number to enter for the auxiliary input filter time constant.

Min/Max history

The min/max history displays the minimum and maximum value for parameters since the last min/max reset. The display values are:

Temp min/max

Temperature minimum and maximum displays the internal temperature of the scintillator sensor in the LFXG-H model level transmitter.

Sensor min/max

The sensor minimum and maximum field displays raw uncompensated counts from the detector.

Aux in min/max

Auxiliary minimum and maximum displays auxiliary input (if used) counts.

Last reset

Displays the date of the last min/max reset.

Resetting the minimum and maximum history

You can reset the minimum and maximum history values so that they record from the time of the reset.

To reset the minimum and maximum history

Procedure 10: Resetting the minimum and maximum history

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **Min/max history**
3. From the **Min/max history** screen, select **Reset min/max**
4. When prompted, select **Yes** to reset the min/max values. Or select **No** to cancel
5. Press F2 to save.

New hardware or EEPROM corrupt

The transmitter contains two electrically erasable programmable read only memory (EEPROM) chips. The EEPROMs store all data specific to that sensor/electronics pair for the installation. The locations of the EEPROMs are:

- On the CPU board
- On the sensor board

Each EEPROM contains a backup of the other EEPROM. The system monitors both EEPROMs at power-up to assure an accurate backup.

If you install a new CPU board, the EEPROM backups on the CPU and sensor boards do not match. The software signals the discrepancy with the error message, New Hardware Found. The transmitter does not automatically perform a backup in case the discrepancy is not due to new hardware, but some corruption of the EEPROM.

Note: Only use the **New hardware** functions if you replace the CPU board.

This function is not necessary if installing a completely new detector assembly. The new detector assembly includes the CPU board and the sensor assembly.

Proper response to "New hardware found" message if new hardware has been installed

When you install a new CPU board, you must verify installation in the **New hardware** screen. This function enables new backups of the EEPROMs.

If a new CPU board has been installed

Procedure 11: New Hardware Found message with new CPU board

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **New hardware**
3. From the **New hardware** menu, select **New CPU board**
4. The prompt, Verify New CPU Board Installed displays. Select **Yes** to allow new backups on the EEPROMs or select **No** to cancel.

Proper response to "New hardware found" message if new hardware has not been installed

CPU EEPROM Corrupt message or Sensor EEPROM Corrupt message

If there has not been an installation of a new CPU board and the error message, New Hardware Found, displays, then one of the EEPROMs is probably corrupt. You normally can repair the corruption with the EEPROM backup.



CAUTION!

If you suspect that an EEPROM is corrupt, we recommend you call VEGA Field Service for advice before performing the following procedure.

To repair the corruption from the EEPROM backup

Procedure 12: Repairing corrupted EEPROM

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **New hardware**
3. From the **New hardware** menu, select **No new hardware**
4. At the prompt, Do You Want To Reconcile Differences?, select **Yes** to allow restoration from backups on the EEPROMs. Or select **No** to cancel.

Test modes

Five independent test modes are available. These test modes are:

1. mA Out test mode
2. Sensor test mode
3. Aux Inp test mode
4. Relay test mode
5. Temperature test

In the test modes, the transmitter stops measuring the process material and allows manual adjustment of critical variables for troubleshooting. The test modes enable independently. However, you can use them in combination to test multiple variable effects. All of the test modes time out automatically after one hour if you do not manually exit.



CAUTION!

While in a test mode, the transmitter is not measuring process and so its current output does not reflect the process value. If your DCS is controlling from the transmitter's current output, be sure to remove the system from automatic control before entering a test mode. The software screens prompt you to do so before entering test mode.

Milliamp output test mode

Use the milliamp output test mode to manually force the current output to a specified value. This is useful for verifying the current loop calibration. Instructions to calibrate the current loop are available in the "Calibration" chapter of this manual.

Note: While in milliamp test mode, the HART communication may post a Status error. This is expected and not an indication of a failure. If the message, Status Error—Ignore Next xx Occurrences? displays, select **Yes** to ignore the Status Error.

Start milliamp output test mode

Procedure 13: Start mA output test mode

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **Test mode**
3. From the **Test mode** menu, select **mA Out test mode**
4. From the **mA Out test mode** menu, select **Enter mA test mode**
5. At the prompt, enter the value of the current output you want to force
6. At the prompt, select **Yes** to start the test mode and send new data
7. The transmitter continues functioning in milliamp test mode until it times out after one hour, or until you choose **Exit mA test mode**.

Exit milliamp output test mode

Procedure 14: Exit mA output test mode

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **Test mode**
3. From the **Test mode** menu, select **mA Out test mode**
4. From the **mA Out test mode** menu, select **Exit mA test mode**
5. At the prompt, select **Yes** to exit the test mode.

Sensor test mode

The sensor test mode simulates the sensor output at a user-defined number of raw counts. This is before application of the following:

- Temperature compensation
- Sensor uniformity gain
- Standardize gain

The true sensor output is ignored while the transmitter is in sensor test mode.

Sensor test mode is extremely useful for verifying the electronics' and software response to input counts without having to perform the following:

- Change the process
- Shield the source
- Vary the radiation field

While in sensor test mode, after entering the desired number of counts, it may be useful to look at the **Process chain** screen to view the variables affected by the raw counts value. To view the **Process chain** screen, back out of the test mode screens pressing the LEFT ARROW. The transmitter continues to operate in sensor test mode until it times out after one hour or until you choose **Exit test mode**.

Start sensor test mode

Procedure 15: Start Sensor test mode

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **Test mode**
3. From the **Test Mode** menu, select **Sensor test mode**
4. From the **Sensor test mode** menu, select **Enter test mode**
5. At the prompt, enter the value of the new counts you want to force
6. At the prompt, select **Yes** to start the test mode and send new data
7. The transmitter continues functioning in sensor test mode until it times out after one hour, or until you choose **Exit test mode**.

Exit sensor test mode

Procedure 16: Exit Sensor test mode

1. From the **Advanced Fxns** menu, select **Test mode**
2. From the **Test mode** menu, select **Sensor test mode**
3. From the **Sensor test mode** menu, select **Exit test mode**
4. At the prompt, select **Yes** to exit the test mode.

Auxiliary input test mode

The auxiliary input test mode simulates the auxiliary input frequency at a user-defined number of counts. The effect of auxiliary input counts depends on the auxiliary input mode. Examples are:

- Temperature probe
- Flow meter
- Second transmitter

While in auxiliary input test mode, after you enter the desired number of counts, it may be useful to look at the **Process chain** screen to view the variables affected by the auxiliary input counts value. To view the **Process chain** screen, back out of the test mode screens using the LEFT ARROW. The transmitter continues to operate in auxiliary input test mode until it times out after one hour or until you choose **Exit auxiliary input test mode**.

Start auxiliary input test mode

Procedure 17: Start Auxiliary test mode

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **Test mode**
3. From the **Test Mode** menu, select **Aux Inp test mode**
4. From the **Aux Inp test mode** menu, select **Aux Inp test mode**
5. At the prompt, select **Yes** to adjust counts
6. Input the Aux counts that you want to force
7. At the prompt, select **Yes** to start test mode and send new data

The transmitter continues functioning in auxiliary test mode until it times out after one hour, or until you choose **Exit Aux test mode**.

Exit auxiliary input test mode

Procedure 18: Exit Auxiliary test mode

1. From the **Advanced Fxns** menu, select **Test mode**
2. From the **Test mode** menu, select **Aux Inp test mode**
3. From the **Aux Inp test mode** menu, select **Exit Aux test mode**
4. At the prompt, select **Yes** to exit the test mode.

Relay test mode

Relay test mode enables the user to manually toggle the relay on or off to test the contacts. This is useful for verifying the functioning of alarm annunciators.

Start relay test mode

Procedure 19: Start Relay test mode

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **Test mode**
3. From the **Test Mode** menu, select **Relay test mode**
4. From the **Relay test mode** menu, select **Enter mA test mode**
5. At the prompt, select **Energize relay** or **De-energize relay**

The transmitter continues functioning in Relay test mode until it times out after one hour, or until you choose **Exit relay test**.

Exit relay test mode

Procedure 20: Exit Relay test mode

1. From the **Advanced Fxns** menu, select **Test mode**
2. From the **Test mode** menu, select **Relay test mode**
3. From the **Relay test mode** menu, select **Exit relay test**.

Temperature test mode

The temperature test mode enables the user to manually force the LFXG-H sensor temperature probe output to a specified value. This is useful for verifying the scintillator sensor temperature compensation. Start temperature test mode

Procedure 21: Start Temperature test mode

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, select **Test mode**
3. From the **Test mode** menu, select **Temperature test mode**
4. From the **Temperature test mode** menu, select **Enter Temp. test**
5. At the prompt, enter the value of the new temperature you wish to force

The transmitter continues functioning in Temperature test mode until it times out after one hour, or until you choose **Exit Temp. test mode**.

Exit temperature test mode

Procedure 22: Exit Temperature test mode

1. From the **Advanced Fxns** menu, select **Test mode**
2. From the **Test mode** menu, select **Temp. test mode**
3. From the **Temp. test mode** menu, select **Exit Temp. test mode**
4. At the prompt, select **Yes** to exit the test mode.

Other advanced functions

Checking the sensor voltage, poll address, equipment version, serial numbers, and temperature coefficients

When performing diagnostics, it may be important to know the following information:

- Sensor voltage
- Poll address
- Version of firmware on the FLASH installed on the level transmitter
- Hardware version number
- Equipment serial numbers
- Temperature coefficients

Sensor voltage

Sensor voltage displays the scintillator sensor voltage

Poll address

Poll address displays the HART poll address of the transmitter. Each transmitter in a current loop must have a unique poll address. This value is meaningful only when multiple transmitters connect on the same loop.

Firmware version

Firmware version displays the firmware version number.

Hardware version

Hardware version displays the hardware version number.

CPU Serial Number

CPU Serial Number displays the CPU serial number.

Sensor Serial Number

Sensor Serial Number displays the sensor serial number.

View temperature coefficients

The algorithm that compensates for variations in measurement output with changes in temperature uses temperature coefficients. The VEGA factory determines the coefficients through rigorous testing. You cannot change these values through normal operation.

Checking the sensor voltage, poll address, version, and serial numbers

Procedure 23: Checking equipment version and serial numbers

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** screen, select **Other advanced**
3. From the **Other advanced** screen, select one of the following:
 - Sensor voltage
 - Poll addr
 - Firmware ver
 - Hardware ver
 - CPU Serial No.
 - Sensor Serial No.
 - View Temp. coefs

Select gauge type

VEGA's nuclear density gauges use much of the hardware and software of the VEGA HART Level transmitters. If your level transmitter indicates PV or Density as the process variable, it was set incorrectly for a level type application. Select gage type enables the users to set the software to operate as either a density or a level gage.

Procedure 24: Select gage type

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, choose **Select gage type**
3. From the **Select gage type** menu, select **Level**
4. If using a HART hand-held communication device, press F2 to send.

Select gauge location

The local gauge refers to a gauge that has its sensor electronics and processing electronics all contained in the same housing. Set a gauge to remote if the sensor electronics and processing electronics are in separate housings and the process signal connects to the auxiliary input of the processing electronics.

Procedure 25: Select gage location

1. From the **Main menu**, select **Advanced Fxns**
2. From the **Advanced Fxns** menu, choose **Select Gage Locati**
3. From the **Select Gage Locati** menu, select either **Local** or **Remote**
4. If using a HART hand-held communication device, press F2 to send.

Chapter 5: Diagnostics and repair

Software diagnostics

The system alerts users to potential problems by:

- Posting messages on the HART screens
- Energizing the output relay
- Distinctly changing the current loop output
- Tracking the status and history of the four current alarms on the Gauge status screen

Alarms

There are four basic alarms. They are:

1. Diagnostic
2. Analog
3. Process
4. X-ray

Table 10: Alarm type summary

Alarm type	Trigger relay	Display HART message	Current loop output affected	Gauge status and history
Diagnostic	Yes	Optional	No	Yes
Analog	No	No	Yes	No
Process	Yes	No	No	No
X-ray	Yes	No	Yes	No

Note: Instructions for setting alarms and their parameters are in Appendix I of this manual.

Diagnostic

This alarm provides information about the transmitter system and when periodic procedures are due. The system alerts you by the following means:

- Appears on the Diagnostics|Gauge status screen (only indicates the status)
- HART messages appear when the LFXG-H connects to the system (if it is set up)
Note: Because some conditions are self-repairing (for example, RAM and EEPROM corruption) they appear in the history screens but not in the diagnostic screens.

Note: The following exceptions acknowledge once you have performed the proper procedure:

- Source wipe due
- Shutter check due
- Standardize due

History information

Information about critical events store in the Diagnostics|Gauge status|View History|Diagnostic history screens. Use these screens to view the newest and oldest trigger records of the following events:

- RAM corrupt
- Sensor EEPROM corrupt
- FLASH corrupt
- Real time clock fail
- Sensor temperature fail
- Standardize due
- Source wipe due
- New hardware found
- CPU EEPROM
- Alarm type 1
- Alarm type 2
- Shutter check due
- Sensor fail
- Process out of range
- Sensor voltage out of spec

Use this information to determine if a problem has recently occurred and internally repaired. An example of this would be an EEPROM corruption.

Summary of diagnostic alarm conditions

Table 11: Diagnostic alarm conditions

Alarm name	Normal / Error	HART message	Problem description	Recommendations
RAM status	Pass/ Fail	RAM corrupt	There has been a corruption of the RAM memory. It has been resolved internally.	Repeated triggering of this alarm indicates a possible hardware problem.*
Sensor EEPROM status	Pass/ Fail	Sensor EEPROM corrupt	Non-critical memory corruption has occurred on the CPU board EEPROM and may not have been resolved internally.	To check if the problem is recurring, acknowledge the alarm and then cycle power to the unit. If alarm occurs again, it indicates a hardware problem. See page 93.
Real time clock test	Pass/ Fail	Real time clock fail	The clock has failed. This can result in a miscalculation of timed events.	Note: You must reset the time and date if the LFXG-H was without power for the past 28 days. To resolve, try to reset the time and date. If it does not reset call VEGA Field Service.
Sensor temp probe test	Pass / Fail	Sensor temp probe fail	The sensor temperature probe may not be functioning. This can result in erroneous measurements.	Check the sensor temperature on the Advanced Fxns Process chain Primary channel screen. If the temperature reads $-0.5\text{ }^{\circ}\text{C}$ constantly, the probe is broken and the sensor assembly may need replacement.*
Standardize due?	No/ Yes	Standardize due	A standardize procedure is due.	Alarm acknowledges when you complete the process standardize procedure in the Calibrations Process stdz screen.
Source wipe due?	No/ Yes	Source wipe due	A source wipe is due.	Alarm acknowledges when you log a source wipe. Refer to page 89 for more information.
CPU EEPROM status	Pass/ Fail	CPU EEPROM corrupt	There has been a corruption of the non-critical memory on the CPU board EEPROM and it may not have been resolved internally.	To check if the problem is recurring, acknowledge the alarm and then cycle power to the unit. If the alarm occurs again, it indicates a hardware problem. See page 93.
Alarm type 1	Not used		Not used in standard software.	Consult VEGA for special software

Alarm type 2	Not used		Same as above.	Same as above.
Shutter check due?	No/ Yes	Shutter check due	A source holder shutter check is due.	Alarm acknowledges when you log a shutter check. See page 89.
New hardware found?	No/ Yes	New hardware found	The CPU board detects a configuration mismatch.	The CPU board or sensor assembly may have been replaced, or one of the EEPROM configurations is erroneous. Refer to page 92 for more information.
Sensor status?	Pass/ Fail	Sensor fail	Less than 1 count seen in the last 10 seconds (as configured by Field Service).	Indicates the sensor is malfunctioning.*
Process out of range?	No/ Yes	Process out of measurement range	Current process value is outside of the minimum or maximum level span setting.	*
Sensor voltage status	Pass/ Fail	Sensor high voltage fail	The high voltage on the PMT is outside the usable range.	Check wiring on CN2..*

*Consult VEGA field service.

Procedure 26: Viewing and acknowledging diagnostic alarms

1. Select Gauge status|Diagnostics from the main menu (the first diagnostic condition appears)
2. Press F4 to view all the conditions
3. If a diagnostic condition is in alarm:
 - Select Acknowledge alarm to clear
 Or,
 - Press NEXT to Ignore the alarm
 The "Current Status Complete" message appears after viewing all of the conditions.

Note: If the relay is set as a diagnostic alarm, you must acknowledge all diagnostic alarms to reset the relay.

Analog

This alerts when the detector indicates the current loop set point value indicates zero counts. No messages appear. If this alarm is on, check for the following:

- Source holder shutter is in the open or on position to create the necessary radiation field
- Extreme build-up on walls or other material is shielding the detector from the radiation field
- Electrical connection damage or disconnection between the sensor assembly and the CPU board

This alarm acknowledges when the 2 mA or 22 mA current loop output value becomes stable.

Process

This alarm causes the relay output to trip when the process level is above or below a setpoint. This alarm only works with the output relay. No messages or Gauge status menu items display this information. This alarm acknowledges when the process value returns back to the setpoint value.

Note: If necessary, you can install a process alarm override switch to manually turn off an annunciator when the level transmitter relay energizes.

X-ray

This alarm compensates for false indicated process values that occur when the gauge detects external radiographic sources. For example, vessel weld inspections often use portable radiographic (x-ray) sources. X-rays that the gauge detects cause a false low reading and adversely affect any control based on the gauge output.

The x-ray alarm can perform the following actions:

- Alter the current loop output to indicate the alarm condition
- Trip the output relay, if the relay is set up to do so

The LFXG-H alarms when it detects a radiation field above a set threshold. The gauge sets the current loop output at its value 10 seconds before the condition. It periodically dithers the output about the average, cycling until the radiation field is back to the normal level or until a time-out period of 60 minutes.

The standard x-ray alarm only triggers when the counts are greater than the cal low count value. These counts are found on the process variable menu. If the x-ray source is setup so that the counts increase but do not go above the cal low counts, the x-ray alarm does not trigger and the gauge reads the x-ray interference as a true process shift.

Auxiliary x-ray alarm system

This alarm detects x-rays that are causing process changes. This extra VEGA system places a second detector outside of the radiation beam of the primary detector. The second detector only monitors x-ray interference. This detector has a frequency output that wires to the auxiliary input of the primary detector. The primary detector's programming triggers the x-ray alarm when the counts of the secondary detector are above a threshold. Contact VEGA for more information about the x-ray interference detection method.

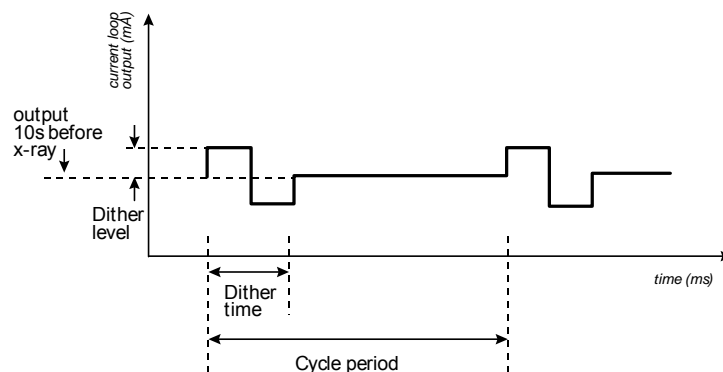


Figure 24: X-ray interference alarm output

Hardware diagnostics

Two circuit boards in the LFXG-H are field replaceable. They are the:

1. Power supply board
2. CPU board

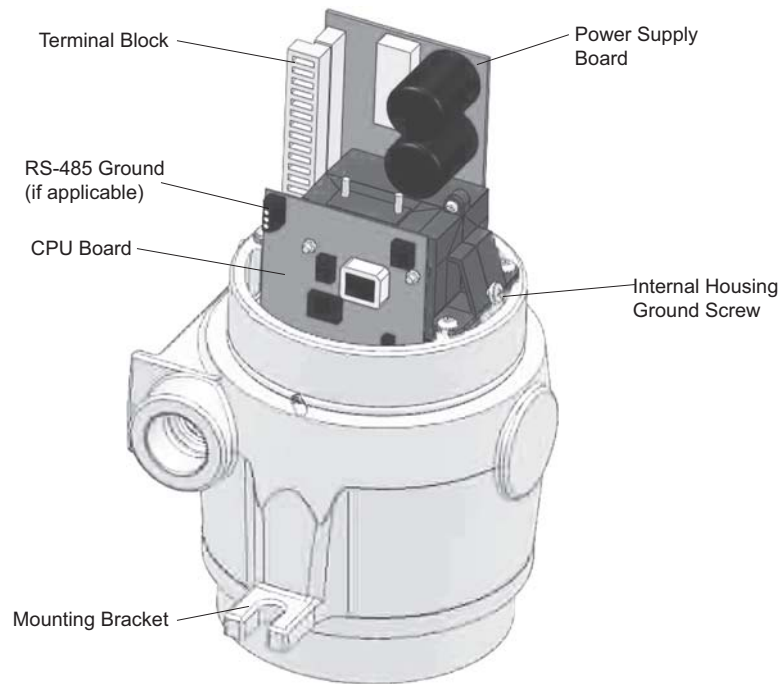


Figure 25: GEN2000 circuit boards

The figure below is a simplified component layout.

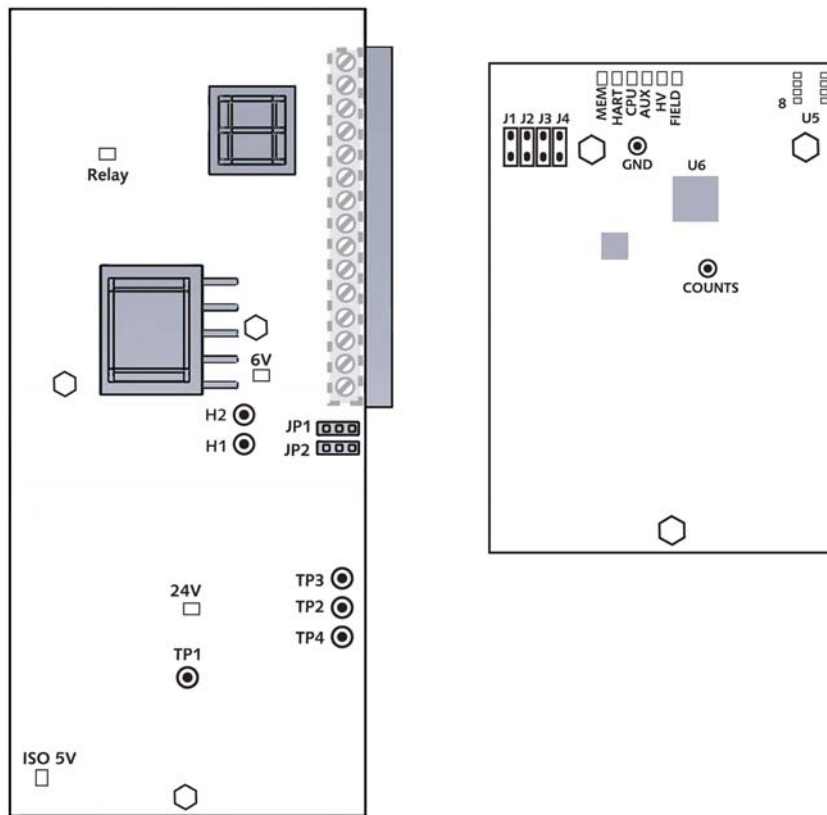


Figure 26: GEN2000 circuit board components - simplified

Test points

Test points are located on the power supply and CPU board..

Table 12: Power supply board test point labels and descriptions

Power supply board test point label	Description
H1	HART connection
H2	HART connection
TP1	Isolated ground
TP2	Loop current test point 200mV/mA loop current. Referenced to isolated ground.

Table 13: CPU test point labels and descriptions

CPU test point label	Description
Count	Raw input signal coming from preamp.
GND	Logic ground
U5 pin 8	+5V power supply test points referenced to Logic ground.

Jumpers

Jumpers JP1 and JP2 on the power supply board set the current loop source or sink mode. Do not change the jumpers from the current setting without consulting VEGA Field Service.

The jumpers for the current loop power source or sink mode are set as follows:

Table 14: Jumper settings

Mode	Jumper setting
Source mode (LFXG-H current loop is self-powered)	JP1 1–2, JP2 2–3
Sink mode (LFXG-H current loop is DCS-powered)	JP1 2–3, JP2 1–2

The LFXG-H does not use jumpers J1-J4 on the CPU board.

LED indicators

Check the basic functioning of the LFXG-H at the instrument with LED indicators on the CPU board. They are visible when you remove the explosion-proof housing pipe cap.

See the Tables on page 84 for the summary of the LED indications.

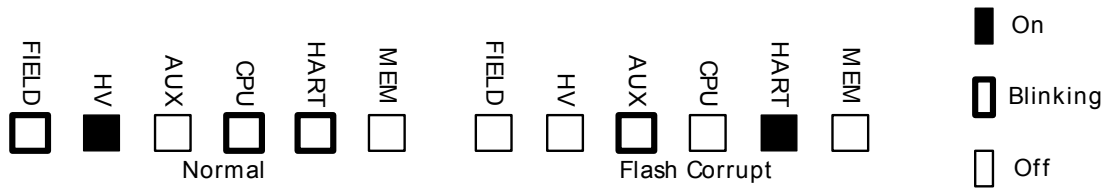


Figure 27: LED indicators

FLASH corrupt LED pattern

The FLASH chip stores the device description (DD) software. The transmitter does not operate if the FLASH chip is corrupt. A HART device that connects to the transmitter displays the message, No Device Found. In this situation, the LED bank displays a distinctive pattern. Call VEGA Field service to report this condition.

Table 15: Power supply board LED summary

Power Supply Board LED summary table

LED	Description	Normal condition	Error condition	Recommendation
+6V	+6V DC voltage level to electronics	ON	OFF—electronics are not receiving +6V DC voltage required for functioning.	Verify +6V on test points. Check fuse on Power Supply board. Check power input terminals 1, 2.
+24V	Analog output loop voltage	ON	OFF—24V not present on 4 ... 20 mA output. 4 ... 20 mA output and HART communications are bad.	Check loop wiring and jumpers JP1, JP2 on Power Supply board. Replace Power Supply board.
Relay	Relay condition indicator	ON when relay is energized. OFF when relay is de-energized.	None	Check against relay output terminals 3, 4, & 5. If no relay output, replace Power Supply board.

CPU Board LED summary table

Table 16: CPU board LED summary

LED	Description	Normal condition	Error condition	Recommendation
Mem	Memory corruption (EEPROMs, FLASH)	OFF	1 blink: CPU EEPROM corrupt 2 blinks: Sensor EEPROM corrupt 3 blinks: Both EEPROMs corrupt 4 blinks: RAM corrupt 5 blinks: Memory mismatch ON solid: combination of errors	Check software diagnostics. Call VEGA Field Service.
HART	HART communication indicator	ON—blinks when receiving HART messages	None	Check HART device connection on loop and HART device functioning.
CPU	Central processing unit on CPU board "heartbeat"	Blinks at rate of 1 time per second	LED does not blink. CPU not functioning.	Check power input. Replace CPU board.
Aux	Auxiliary input frequency signal indicator	Blinks if auxiliary input present. OFF if no auxiliary input present	None	Check auxiliary input wiring terminals 11 and 12 with a meter for frequency signal. Check auxiliary input equipment.
HV	Sensor high voltage	ON—high voltage is in spec	OFF—high voltage is out of spec	Call VEGA Field Service
Field	Radiation field indicator	Cycles in proportion to radiation field intensity at detector. ON for 10 seconds for each mR/hr, then off for two seconds. (Can use LED 5 that blinks 1 time/sec to time LED 9 for field indicator.)	None	A 1mR/hr (2,580nC/kg/hr) field is usually required for a measurement. Check for closed source shutter, buildup, & insulation.

Troubleshooting

Use the following flow charts to determine the source of a problem. They cover three topics:

- HART communication problems
- LFXG-H transmitter not responding
- Measurement not correct

Hardware troubleshooting is only available at the board level.

Communication problem flowchart

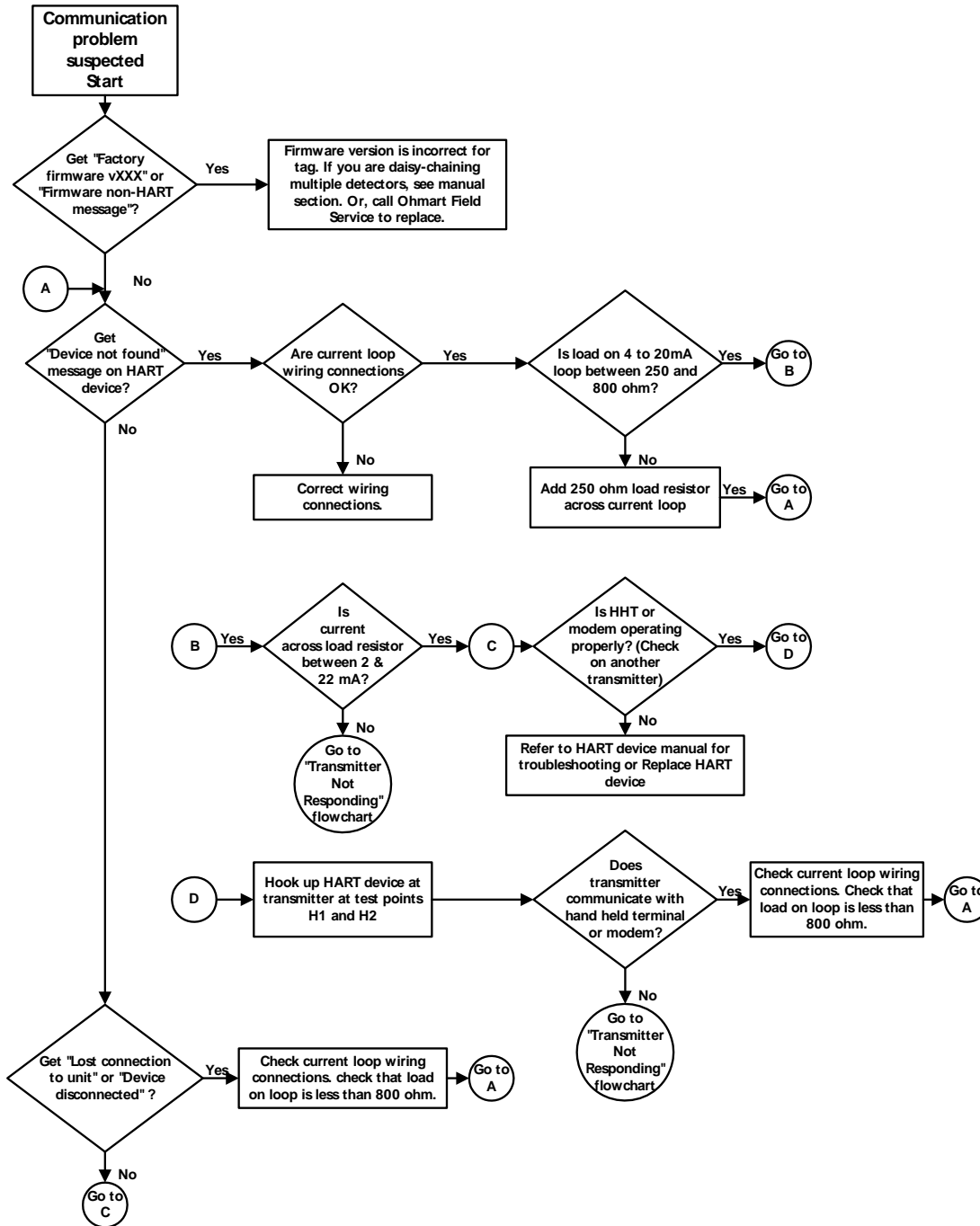


Figure 28: Communication problem flowchart

Transmitter not responding flowchart – part 1

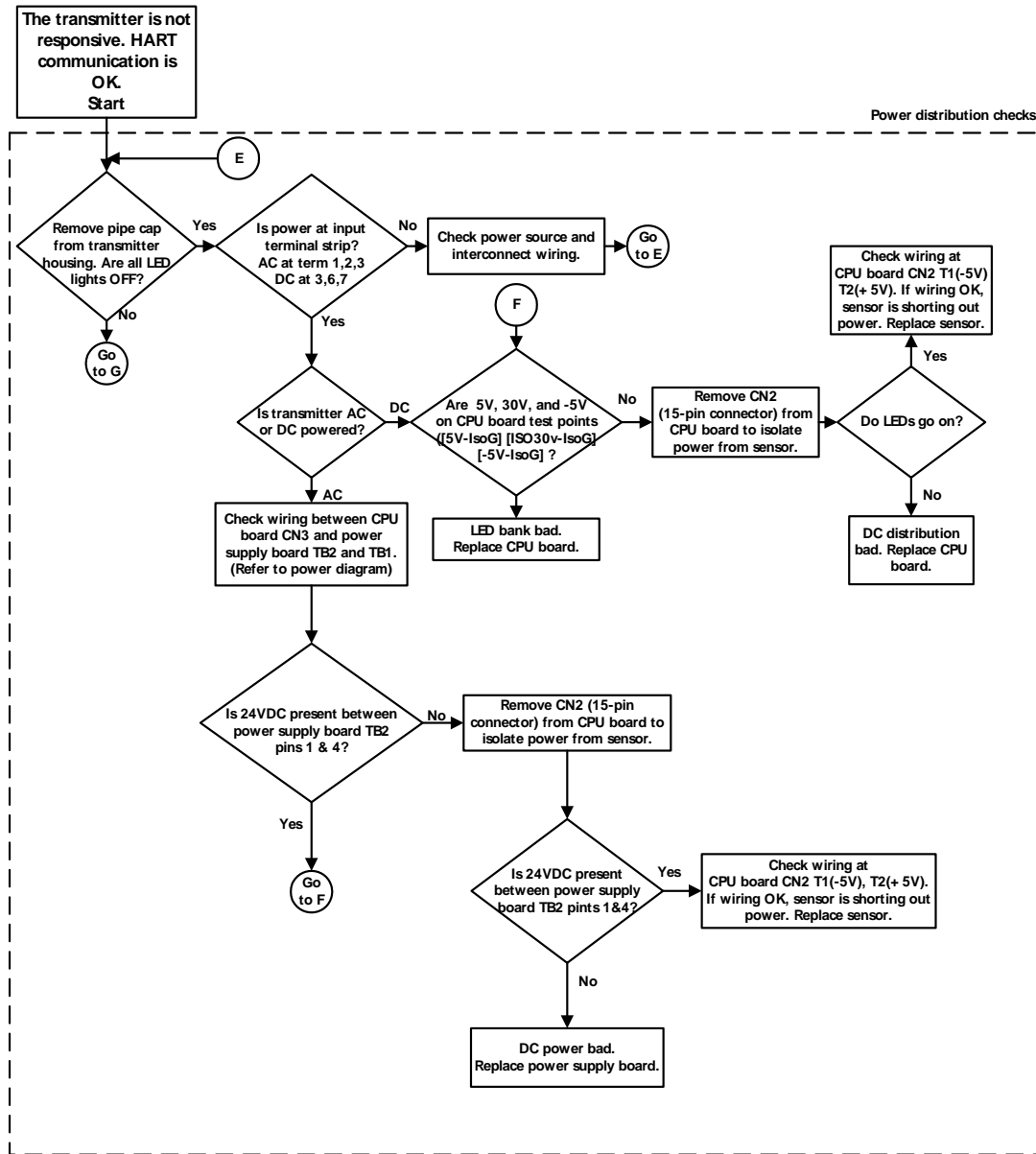


Figure 29: Transmitter not responding flowchart – Part 1

Transmitter not responding flowchart – part 2

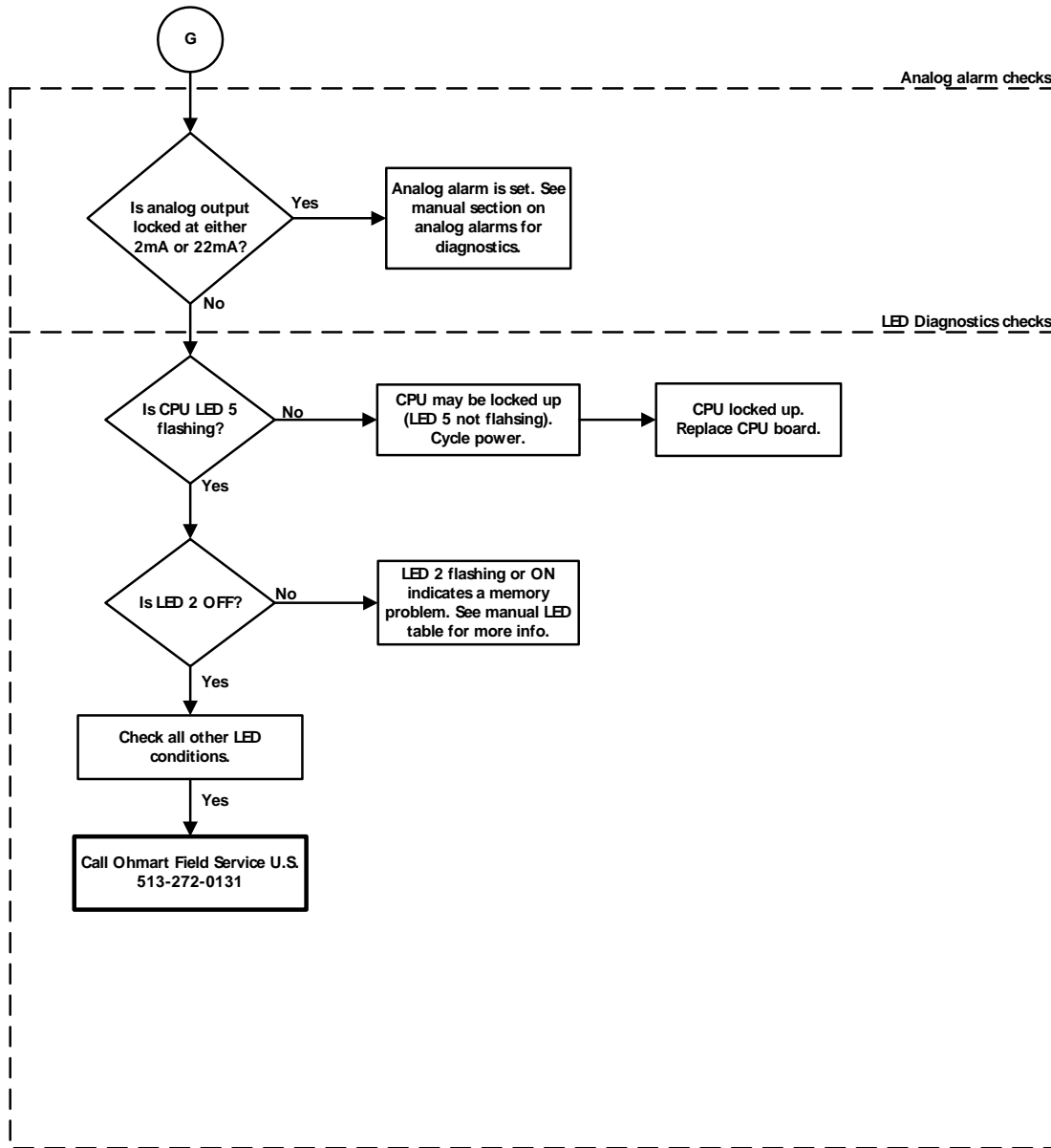


Figure 30: Transmitter not responding flowchart – part 2

Maintenance and repair

Periodic maintenance schedule

Since the LFXG-H contains no moving parts, very little periodic maintenance is required. We suggest the following schedule to prevent problems and to comply with radiation regulations:

Table 17: Periodic maintenance schedule

Description	Frequency	Procedure
Standardize	As required by process conditions, usually at least once a month	Calibration chapter
Source holder shutter check	Every six months unless otherwise required by applicable nuclear regulatory agency	Radiation safety instructions shipped separately with source holder and following instructions
Source wipe	Every three years unless otherwise required by applicable nuclear regulatory agency	Radiation safety instructions shipped separately with source holder and following instructions

Source wipe and shutter check recording

The LFXG-H can automatically remind users when a source wipe and shutter check are due, using the diagnostic alarms. If you use this feature, you must record the source wipes and shutter checks in the software to acknowledge the alarm and to reset the timer.

Perform the following procedure after a source wipe or a shutter check. Refer to the “Radiation Safety for U.S. General and Specific Licensees, Canadian, and International Users” manual and the “Radiation Safety Manual Addendum of Reference Information” CD.

Recording a source wipe or shutter check

Procedure 27: Recording a source wipe or shutter check

1. From the Main menu, select Initial setup
2. From the Initial setup menu, select System parameters
3. From the System parameters menu, select Source function
4. From the Source function menu, select Record wipe, or select Record shut chk
5. At the prompt, select Yes to start recording.

Check when the next source wipe or shutter check is due

Procedure 28: Check due date of source wipe or shutter check

1. From the Main menu, select Initial setup
2. From the Initial setup menu, select System parameters
3. From the System parameters menu, select Source function
4. From the Source function menu, select Next wipe/shut due
5. From the Next wipe/shut due menu, select Next wipe due to view the due date
6. From the Next wipe/shut due menu, select Next shut chk due to view the due date
7. Press F4 to exit.

Spare parts

Contact VEGA Field Service at +1 513-272-0131 for parts, service, and repairs.

Outside the U.S., contact your local VEGA representative for parts, service, and repairs.

Field repair procedures

Very few parts are field repairable, but you can replace entire assemblies or boards. The following parts are replaceable:

- CPU circuit board
- Power supply circuit board

Use great care to prevent damage to the electrical components of the gauge. VEGA recommends appropriate electrostatic discharge procedures.

Replacing the CPU or Power supply board

You may have to replace a circuit board if there is damage to one of its components. Before replacing a circuit board, check the troubleshooting flowcharts or call VEGA Field Service to be sure a replacement is necessary.

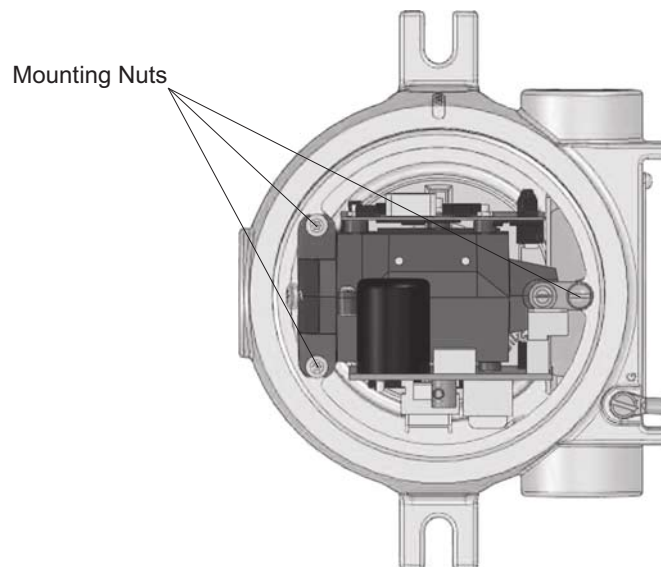
The sensor EEPROM contains a backup of the CPU board EEPROM. After physically replacing the CPU board, you must perform a memory backup to update the CPU board EEPROM with the information in the sensor board EEPROM. Perform the memory back up in the Advanced Fxns|New hardware screen.

Replace the CPU or Power supply board

Procedure 29: Replacing the CPU or power supply board

1. Shut off the power to the LFXG-H
2. Remove the housing cover
3. Remove the plastic electronics cover
4. Remove the terminal wiring connector
5. Remove the three (3) screws holding the electronics package in place.
6. Carefully pull the electronics package out of the housing.
7. Remove the appropriate board from the clamshell assembly by removing the
Note: If you are changing the CPU board, you must move the old firmware chip
8. Carefully reconnect any ribbon cables.
9. Install the electronics package in the housing.
10. Replace the three (3) mounting nuts.
11. Reconnect the terminal wiring connector.
12. Install the plastic electronics cover
13. Install the housing cover.
14. Turn on the power to the unit.
15. Connect a HART communicator to the unit and verify that the unit is operational.

Note: If you change the CPU board, a New Hardware Found error message displays when you connect with the HART communicator. This is normal. Follow the procedure on page 59 for installing new hardware so that the non-volatile memory on the CPU can configure properly.



Requesting field service

To request field service within the U.S. and Canada; call 513-272-0131 from 8:00 A.M. to 5:00 P.M. Monday through Friday. For emergency service after hours, call 513-272-0131 and follow the voice mail instructions.

Returning equipment for repair to VEGA

When calling VEGA to arrange repair service, have the following information available:

- Product model that is being returned for repair
- Description of the problem
- VEGA Customer Order (C.O.) Number
- Purchase order number for the repair service
- Shipping address
- Billing address
- Date needed
- Method of shipment
- Tax information

Returning equipment for repair

Procedure 30: Returning equipment for repair

1. Call VEGA Nuclear Products Repair at 513-272-0131 between Monday and Friday, 8:00 A.M. to 5:00 P.M. United States Eastern Standard Time
2. VEGA assigns the job a material return authorization (MRA) number

Please note: VEGA reserves the right to refuse any shipment that does not have a MRA number assignment.

3. Indicate the MRA on the repair service purchase order
4. Clearly mark the shipping package with the MRA number
5. Send the confirming purchase order and the equipment to:
VEGA Americas, Inc.
Attention: Repair Department
4170 Rosslyn Drive
Cincinnati, OH 45209-1599 USA

Note: You must first contact VEGA and receive a material return authorization number (MRA) before returning any equipment to VEGA. VEGA reserves the right to refuse any shipment not marked with the MRA number.

Notes

Appendix I: Initial factory setup

Perform all setup functions from the **Initial setup** menu. These functions include the following:

- Process parameters
- System parameters
- Alarms
- Auxiliary inputs
- Spans setup

Perform setup before the initial calibration, since some parameters are necessary for calibration. Some of these parameters are:

- Units
- Data collect times

Process parameters

Units

Level units

The following engineering units are available for a level measurement:

- In—inches
- ft—feet
- cm—centimeters
- mm—millimeters
- m—meters
- %—percent
- Spcl—special (used in conjunction with Custom units, below)

Custom units

You can program a custom unit if the unit you require is not in the standard list. Choose the unit **Spcl** (Special) from the **Units** screen. Enter the numeric conversion factor in the form:

x custom units / inch

Setting the process units

Procedure 31: Setting the process units

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Process parameters**
3. From the **Process parameters** menu, select **Process units**
4. From the **Process units** menu, select **Level units**
5. From the **Level units** screen, scroll through the list and choose the correct level unit for your process by pressing F4 to enter. You will need to enter a custom unit if the unit you want is not in the list. See the procedure for setting custom units in this section
6. After selecting the units, press F2 to send the information to the transmitter. This ensures that other setup and calibration functions you perform use the desired engineering units.

Setting custom units

Procedure 32: Setting custom units

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Process parameters**
3. From the **Process parameters** menu, select **Process units**
4. From the **Process units** menu, select **Custom units**
5. From the **Custom units** screen, select **Conversion to length**
6. Enter the conversion factor in factor in custom units per inch
7. Press F4 to enter
8. Press the LEFT ARROW to move back to the **Process units** menu
9. From the **Process units** menu, select **Level units**
10. In the **Level units** screen, select **Spcl** as the units
11. If using a hand-held HART Communicator, press F2 to send the units to the transmitter. This ensures that other setup and calibration functions use the correct engineering units.

Calibration parameters

Data coll interval

Data collection interval is the time in seconds over which the system collects a process measurement. Use this interval time to collect data for:

- Initial calibration
- Linearizer curve
- Standardization

Warn % span cal

Warning percentage span calibration is the difference between the two initial calibration points (cal low level and cal high level) as a percent of level span that causes a warning to appear. For a good calibration, it is important for the two initial calibration points to be as far apart as possible. The default value is 10%. The user typically does not need to change this value for most applications.

Process stdz type

Process standardize type determines how you enter the actual process value of a standardize sample. If this is set as Use Lab sample value, the software screens prompt entry of the sample value during a standardize. If this is set as Use Default value, the software always uses the Default standardize level as the sample value.

Default std

Default standardize is the default level value in engineering units that you use in the standardization procedure. At standardization, enter the actual level of the process material to override this default.

Stdz interval

Standardize interval is the interval in days between standardize alarms. The level transmitter alarms to indicate that a standardize procedure is due if the diagnostic alarm, Standardize due, is toggled on.

Setting the calibration parameters

Procedure 33: Setting the calibration parameters

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Process parameters**
3. From the **Process parameters** menu, select **Cal parameters**
4. From the **Cal parameters** menu, select the calibration parameters to view or edit, as needed. Refer to the help screens (F1) or page 99 in this manual for descriptions. View or edit the following parameters:
 - Data coll interval
 - Warn % cal span
 - Process stdz type
 - Default std
 - Stdz interval
5. If using a hand-held HART Communicator, press F2 to send the updated calibration parameters to the transmitter.

Filtering

This feature enables change to the response time of the system by increasing or decreasing the averaging time that is used to filter the noise in the signal. An increased time for averaging enables the accumulation of a greater number of readings and therefore produces a greater statistical accuracy. However, this is at the expense of response time to changes in the process.

Type (RC exponential or rectangular window)

The level transmitter offers a choice of signal filters, RC exponential or rectangular window. The level transmitter has a sample rate of about 1 sample/second, but process variables generally change measurably on the order of minutes. Electrical and source noise occur on the order of seconds, so they can be filtered out with a low pass filter, leaving only the change in the process variable in the signal.

RC exponential

RC exponential filtering simulates the traditional Resistance/Capacitance filtering. It provides an infinite impulse, in which all of the previous samples contribute less and less to the average, but all contribute somewhat. The most recent samples are weighted most heavily in computing the average. Compared to rectangular window filtering, RC exponential filtering provides a quicker response to step changes in the process but has a larger noise band.

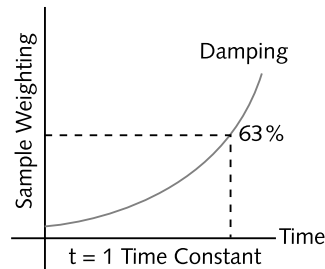


Figure 31: RC exponential filtering

Rectangular window filtering

Rectangular window filtering computes an average based only on a specified (finite) number of samples. All samples are weighted equally in the average. Although it provides a slower step response (since the most recent measurements are weighted the same as those further back in time), it produces a less noisy signal. Generally, rectangular window linear averaging by itself produces results similar to combining RC exponential filtering with the fast cutoff feature.

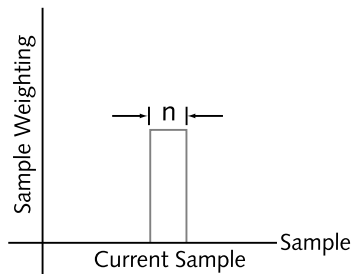


Figure 32: Rectangular window filtering

Damping

The type of filter you choose determines the damping function.

With the RC exponential method, the damping entry is equivalent to a time constant, that is, the amount of time (in seconds) that it takes for the gauge reading to achieve 63.2% of a step change in process. A range of integer values from 1–600 seconds is possible for this time constant entry.

With the rectangular window filtering, the damping entry determines how many samples to use when calculating the average, responding to 100% of a process step change. The maximum damping entry is 100 with this type of filtering.

Fast response cutoff

Fast response cutoff temporarily bypasses the RC or digital filtering when the change in process exceeds this value (in engineering units) between successive samples. This enables the level transmitter to respond immediately to large step changes while filtering the smaller variations in the signal caused by noise and normal process variations. To turn off the fast cutoff filter, set the value to zero.

Selecting a filter type, damping, and fast cutoff

Procedure 34: Selecting a filter type, damping, and fast cutoff

1. From the **Main menu**, select **Initial setup**
 2. From the **Initial setup** menu, select **Process parameters**
 3. From the **Process parameters** menu, select **Filtering**
 4. From the **Filtering** menu, select **Filter type**
 5. On the **Filter type** screen, the currently used filter type displays as either RC Exp Filter or Rect Window Filter. To change the filter type, select either **RC Exp Filter** or **Rect Window Filter**. Press F4 to enter
 6. From the **Filtering** menu, select **Damping**
 7. From the **Damping** screen, enter the damping desired and F4 to enter. Refer to the help screens (F1) or page 101 in this manual for details
 8. From the **Filtering** menu, select **Fast cutoff**
 9. From the **Fast cutoff** screen, enter the cutoff value desired and press F4 to enter. Refer to the help screens (F1) or page 101 in this manual for details
- Note:** To turn off Fast cutoff, enter 0 as the value.
10. If using a hand-held HART Communicator, press F2 to send the updated filtering parameters to the transmitter.

Span settings

The spans for the process, current loop, and any optional auxiliary input are set in the **Spans** screen from the **Initial setup**, **Process parameters** menus.

Process span

Process span **is** the anticipated lowest and highest level (Min and Max level) measurement with the gauge. The level transmitter calibrates within these settings. These define the endpoints for the calibration and linearizer curve. This does not define the span for the output current loop. Refer to the “Current Loop Span” procedure in this section.

Note: The Min and Max Level values for the process span are essential to proper calibration of the system. You must enter the Min and Max level for process span before you perform an initial calibration. You must perform a new initial calibration procedure if the values for the process span Min or Max levels change.

Modify the span setting if the level transmitter moves from its intended location, or is measuring on a different span. It is a good practice to verify that the setting is correct before performing an initial calibration.

Setting process span

Procedure 35: Setting the process span

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Process parameters**
3. From the **Process parameters** menu, select **Spans**
4. From the **Spans** menu, select **Process span**
5. From the **Process span** screen, set both the minimum and maximum values for the measurement span
6. Press F2 to send the setting to the transmitter.

Current loop span

The current loop output can be set to be either “forward acting” or “reverse acting” by choosing the appropriate values of 4 mA Level and 20 mA Level. A forward acting output is proportional to the level and a reverse acting output is inversely proportional to the level. See Table 18 for an example of settings for process values of 0% and 100%:

The current loop span is the lowest and highest level to be indicated by the 4 ... 20 mA current loop (analog output). These settings do not have to be the same as the process span settings (Min level and Max level), but must be within the boundaries set for the process span. The screens prompt entry of a 4 mA level and a 20 mA level.

Table 18: Setting process values of 0% and 100%

Forward acting (proportional)		Reverse acting (inversely proportional)	
4 mA Level	20 mA Level	4 mA Level	20 mA Level
0%	100%	100%	0%

Procedure 36: Setting the current loop span

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Process parameters**
3. From the **Process parameters** menu, select **Spans**
4. From the **Spans** menu, select **Current loop span**
5. From the **Current loop span** menu, select **4 mA Level**
6. In the **4 mA Level** screen, enter the minimum value for the measurement span
7. From the **Current loop span** menu, select **20 mA Level**
8. In the **20 mA Level** screen, enter the maximum value for the measurement span
9. Press F2 to send the setting to the transmitter.

System parameters

The system parameters define settings for the internal operation of the level transmitter and the radiation source.

Time

Current time in HH:MM:SS as set in the real time clock. The time maintains during power failure for up to 28 days. It is important to enter the correct time and date, because they are used for several internal calculations. Time reverts to 00:00:00 on clock failure.

Date

Current date in MM/DD/YY (month, day, year) format. The date reverts to 00/00/00 on failure.

Setting the time and date

Procedure 37: Setting the time and date

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **System parameters**
3. From the **System parameters** menu, select the **Time and Date**
4. From the **Time and Date** menu, select **Time**
 - Enter the current time
 - Press F4 to save the time setting
 - Press the LEFT ARROW key to return to the previous **Time and Date** screen
5. From the **Time and Date** screen, select **Date**
 - Enter the current **Date**
 - Press F4 to save the date setting
6. If using a hand-held HART Communicator, press F2 to send the updated parameters to the transmitter.

Source type

Use the Source type feature to view or enter the isotope in the source holder that produces the radiation signal. The VEGA factory enters this parameter based on information received at the time of the order. You can check the isotope type against the source holder label.

Procedure 38: Setting the source type

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **System parameters**
3. From the **System parameters** menu, select **Source type**
4. In the **Source type** screen, select one of the following source types:
 - Cs 137
 - Co 60
 - Am 241
 - Cf 252
 - No source
5. Press F4 to enter
6. If using a hand-held HART communicator, press F2 to send the updated parameters to the transmitter.

Source function

Wipe Interval

Use the Wipe interval feature to view or enter the interval in days between successive source wipe diagnostic alarms. Check with current applicable regulations.

Record wipe

Use the Record wipe feature to record the date and time when you perform a source wipe. This resets the diagnostic alarm “source wipe due.” For more information, see the “Diagnostics and Repair” chapter.

Shut chk Interval

Use the Shutter check interval feature to enter the number of days between successive shutter check diagnostic alarms. Check with current applicable regulations for recommendations on shutter check intervals.

Record shut chk

Use the Record shutter check feature to record the date and time when you perform a shutter check. This resets the diagnostic alarm “shutter check due.” For more information, see the “Diagnostics and Repair” chapter.

Next wipe/Shut due

Use the Next wipe and Shutter check due features to view or enter the due date for the next source wipe and shutter check. For more information, see the “Diagnostics and Repair” chapter.

Tag

The tag is a unique eight-digit identifier for instrument. If provided at the time of your order, this parameter is entered at VEGA factory prior to shipment. Otherwise, you can enter it on this screen.

Setting the tag identifier

Procedure 39: Setting the tag identifier

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **System parameters**
3. From the **System parameters** menu, select **Tag**
4. In the **Tag** screen, enter the eight digit identifier for the instrument
5. Press F4 to enter
6. Press F2 to send the updated parameters to the transmitter.

System information

Message

Use this text field to record information or messages. For example, this is where you can record a message to operators or notes about the gauge.

Procedure 40: Setting the system information message

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **System parameters**
3. From the **System parameters** menu, select **System info**
4. From the **System info** menu, select **Message**
5. In the **Message** screen enter messages or notes for the operator
6. Press F4 to enter
7. If using a hand-held HART communicator, press F2 to send the updated parameters to the transmitter.

Descriptor

This is a shorter message field to record information or messages.

Procedure 41: Setting the descriptor

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **System parameters**
3. From the **System parameters** menu, select **System info**
4. From the **System info** menu, select **Descriptor**
5. In the **Descriptor** screen enter a short message or note for the operator
6. Press F4 to save
7. If using a hand-held HART Communicator, press F2 to send the updated parameters to the transmitter.

Setting up alarms

Four types of alarms are available:

1. Diagnostic
2. Analog
3. Process
4. X-ray

The “Diagnostics and Repair” chapter thoroughly explains use and acknowledgement of alarms. When you set up alarms, the following options are available:

- Which alarm type triggers the output relay
- Which diagnostic messages appears on the HART display screens
- The output level of the analog alarm
- Specialized parameters of the x-ray alarm

Diagnostic alarm setup

Diagnostic alarms give information about the condition of the level transmitter and can provide reminders to perform periodic maintenance procedures. The reminders appear as messages on the HART screens, when a HART device connects to the level transmitter. In addition, if the level transmitter relay is set as a diagnostic alarm, the condition trips the relay on.

In the setup, there is a list of every diagnostic alarm condition that can toggle On or Off. If the condition flag is Off, that condition does not cause the diagnostic alarm relay to trigger and no HART message appears. The following table lists the available diagnostic alarms conditions. See the “Diagnostics and Repair” chapter, page 78 for more details.

Table 19: Diagnostic alarm conditions

RAM corrupt	Standardize due	CPU EEPROM corrupt
Sensor EEPROM corrupt	Source wipe due	Alarm Type 1
Flash corrupt	New hardware found	Alarm Type 2
Real time clock	Sensor fail	Shutter check due
Sensor temp	Sensor high voltage fail	Process out of measurement range

Setting the diagnostic alarm conditions

Procedure 42: Setting the relay as a diagnostic alarm

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Alarms**
3. From the **Alarms** menu, select **Mode configuration**
4. From the **Mode configuration** menu, select **Diagnostic alarm**
5. If using a hand-held HART communicator, from the **Diagnostic alarm** menu, select **Diagnostic Gp1** (Diagnostic Group 1). If using VEGA View, proceed to the next step
6. From the **Diagnostic Gp1** screen, scroll through the list of diagnostic conditions that can be used to activate the relay
 - Toggle the conditions **On** or **Off** with the F2 key
 - Press F4 to enter
 - Press the LEFT ARROW key to return to the **Diagnostic alarm** screen
7. If using a hand-held HART Communicator, from the **Diagnostic alarm** menu, select **Diagnostic Gp2** (Diagnostic Group 2)
8. From the select **Diagnostic Gp2** screen, scroll through the list of diagnostic conditions and toggle the conditions **On** or **Off**
9. If using a hand-held HART communicator, press F2 to send the setting to the transmitter.

Setting the relay as a diagnostic alarm

Procedure 43: Setting the diagnostic alarm conditions

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Alarms**
3. From the **Alarms** menu, choose **Set relay function**
4. From the **Set relay function** menu, select **Diagnostic** and press F4 to enter
5. If using a hand-held HART communicator, press F2 to send the setting to the transmitter.

Analog alarm setup

The analog alarm uses the current loop analog output to signify that the sensor is outputting zero counts. In this case, the analog output sets to either 2mA or 22mA, and no longer tracks the process level.

The user can choose the 2mA or the 22mA setting for the analog alarm.

Table 20: Analog alarm conditions

Alarm out 22mA	Alarm out 2mA
----------------	---------------

Setting the analog alarm output

Procedure 44: Setting the analog alarm output

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Alarms**
3. From the **Alarms** menu, select **Mode configuration**
4. From the **Mode configuration** menu, select **Analog alarm**
5. From the **Analog alarm** menu, select **Alarm output**
6. From the **Alarm output** menu, select either **22mA** or **2mA**
7. Press F4 to enter
8. If using a hand-held HART communicator, press F2 to send the change to the transmitter.

Process alarm setup

Use the process alarm setup to make the relay output a high or low process alarm. For a low limit, a process level below a set point energizes the relay; for a high limit, a process level above a set point energizes the relay.

Process alarms only work in conjunction with the output relay. No HART messages post that relate to the process alarm.

You cannot use a relay as a diagnostic or x-ray alarm if you have set it as a process alarm.

Table 21: Process relay set alarm conditions

Relay action limit—High limit	Relay action limit—Low limit	Relay setpoint %
-------------------------------	------------------------------	------------------

Setting up the process alarm

Procedure 45: Setting up the process alarm

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Alarms**
3. From the **Alarms** menu, choose **Set relay function**
4. From **Set relay function** menu, select **Process** and press F4 to enter
5. Press the LEFT ARROW key to return to the **Alarms** menu
6. From the **Alarms** menu, select **Mode configuration**
7. From the **Mode configuration** menu, select **Process relay set**
8. From the **Process relay set** menu, select **Relay action**
9. From the **Relay action** screen, select either **High limit** or **Low limit**
10. From the **Process relay set** menu, select **Relay setpoint**
11. From the **Relay setpoint** screen, enter the numeric value of the alarm setpoint in process units and press F4 to enter when finished entering the value
12. If using a hand-held HART communicator, press F2 to send the setting to the transmitter.

X-ray alarm setup

The x-ray alarm compensates for false indicated process values that occur when external radiographic sources the gauge detects. Vessel weld inspections often use portable radiographic sources. Detection of x-rays by the gauge causes a false low reading and adversely affects any control based on the gauge output.

The x-ray alarm distinctly changes the current loop mA output in response to a marked increase in radiation field. It can also trigger the output relay, if set up to do so.

When the gauge detects a radiation field above a set threshold (as a percentage of the cal low counts value), it sets the current loop output at its value 10 seconds before the detection of the x-ray interference. It periodically dithers the output about the average, cycling until the radiation field is back to the normal level or until a time-out period of 60 minutes. See the following figure for a diagram of the current loop output in x-ray interference mode.

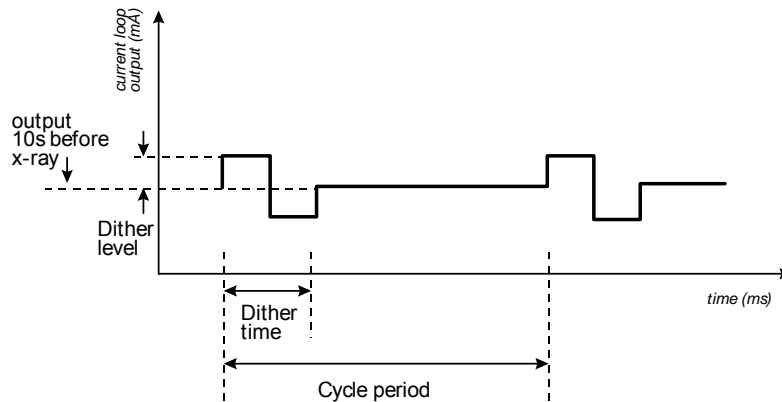


Figure 33: X-ray interference alarm output

Note: Only VEGA Field Service can adjust the time-out period of 60 minutes and the reversion to 10 seconds before the x-ray detection.

In the **Initial setup** screens, you can adjust the parameters shown in Figure 33. The parameters are:

Threshold

Threshold is the percentage beyond the calibration low counts that triggers x-ray interference suppression. Default value 1%.

Dither level

Dither level is the magnitude in mA above and below the average output of the current loop dithering. Default value 1mA.

Cycle period

Cycle period is the repetition rate for presenting the current loop dither in x-ray interference output mode. Default value 1s.

Dither time

Dither time is the percentage of the cycle period to output the dither. Default value 1%.

Table 22: X-ray alarm conditions

Threshold	Dither level
Dither time	Cycle period

Setting up the x-ray alarm parameters

Procedure 46: Setting up the x-ray alarm parameters

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Alarms**
3. From the **Alarms** menu, select **Mode configuration**
4. From the **Mode configuration** menu, select **Xray alarm**
5. Edit the following values as necessary:
 - Threshold
 - Dither level
 - Cycle period
 - Dither time
6. If using a hand-held Communicator, press F2 to send the changes to the transmitter.

Setting the relay as an x-ray alarm

Procedure 47: Setting the relay as an x-ray alarm

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Alarms**
3. From the **Alarms** menu, choose **Set relay function**
4. From the **Set relay function** menu, select **X-ray**
5. Press F4 to enter
6. If using a hand-held HART Communicator, press F2 to send the setting to the transmitter.

Auxiliary input settings

The auxiliary input is an option for the HART level transmitter to receive a frequency signal. With special software, the frequency signal incorporates into the final output.

The software provides special settings for three typical uses of a frequency input:

- Summation mode
- NORM compensation
- Vapor pressure compensation

Note: Refer to Appendix II, for complete application information on using the following compensation or application methods:

- Summation
- NORM
- Vapor pressure
- RS-485 Local Network
- Auto Zero

Input filter

Input filter is the auxiliary input signal with application of the time constant. The filter type (RC or rectangular window) applied to the auxiliary input is the same as the primary channel.

Setting the auxiliary input filter

Procedure 48: Setting the input filter

1. From the **Main menu**, select **Auxiliary input**
2. From the **Auxiliary input** menu, select **Filter TC**
3. In the **Filter TC** screen, input the value for the filter time constant
4. Press F4 to enter
5. If using a hand-held HART Communicator, press F2 to send the setting to the transmitter.

Appendix II: Special applications

This chapter provides application specific information for special installations.

If your application is not in this chapter, you may find application specific information on the certified drawings provided by VEGA or the engineering contractor. If you have other application questions, contact VEGA Field Service in the U.S. or Canada at 513-272-0131 or your local rep outside of the U.S. or Canada.

Note: To use the compensation features of the HART gauge, you must be using VEGA View 2.0 (or higher) or have a HART hand-held communicator programmed with the VEGA COMP device description.

Multiple detectors summation

Some applications require a measurement length longer than the maximum level transmitter detector length.

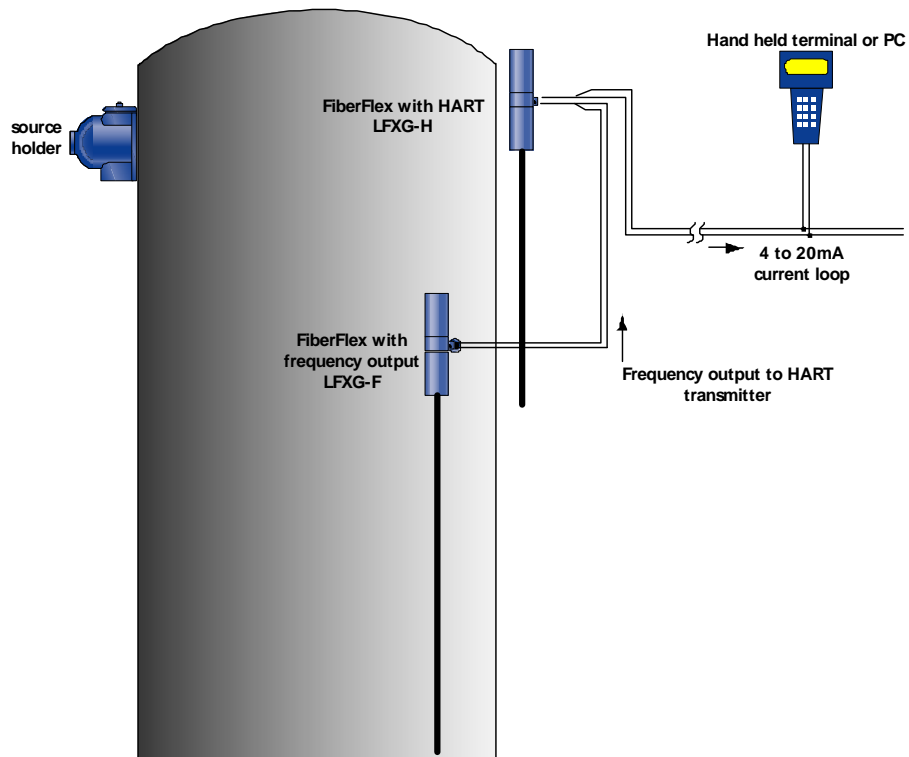


Figure 34: Multiple detectors summation

Special drawings from VEGA

Identification of applications that require multiple detectors occurs at the time of order. The end user, engineering contractor (or both) receive certified drawings for the exact equipment ordered. Refer to the drawings along with this section of the manual.

Note: If the instructions on the drawings and this manual differ, follow the drawing instructions. They will be specific to your order.

Notes on the frequency output detector

You may not receive a separate manual for the detector that provides the frequency output for the HART level transmitter, especially if ordered as part of a complete system that included a HART level transmitter. The certified drawings and this manual section have sufficient information, in most cases.

Some special notes about the frequency output detector are below:

- Model LFXG-F uses much of the same hardware as the model LFXG-H (the HART level transmitter model). They look similar; so verify that you are installing the correct detector as the frequency output slave detector.
- Model LFXG-F uses a different version of firmware than LFXG-H. This firmware enables a frequency output instead of the HART output.
- Some spare parts are unique to the frequency output models. See the following tables for the spare part descriptions and part numbers.

LFXG-F spare parts

Table 23: LFXG-F spare parts

Description	VEGA part number
Power supply board	239747
LFXG-F CPU board	241110
125 mA fuse on power supply board	238661
2.0A fuse on power supply board	240539

Installation requirements

A multiple detector application consists of one HART level transmitter and one (or more) level gauges that output a frequency to the HART transmitter. Follow these installation guidelines:

- Install the detector with the HART output (model LFXG-H) at the top of the vessel. Install the other detector(s) beneath the HART detector.
- The mounting tabs of the detectors define the active, or sensing, length. Offset the detectors vertically so that the end of the top detector's active length corresponds to the beginning of the bottom detector's active length.
- Place all detectors in the radiation beam.

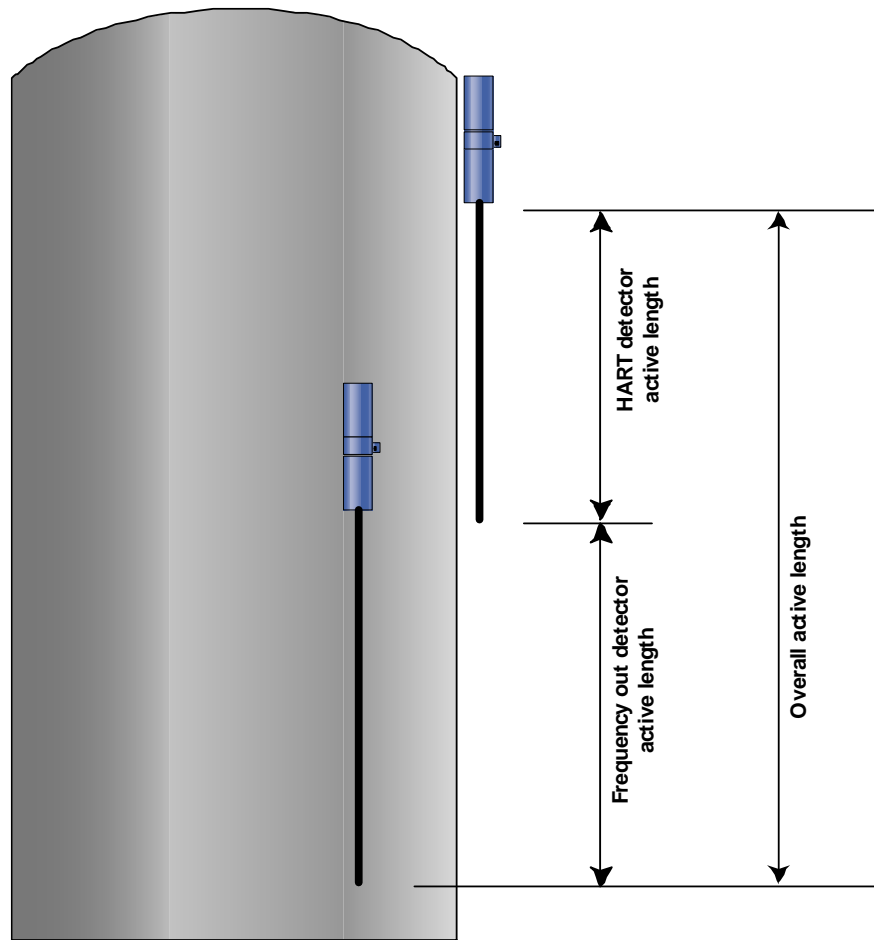


Figure 35: Placement of multiple detectors

Detector wiring

Multiple detectors application require (at least) one frequency output detector and only one HART output detector.

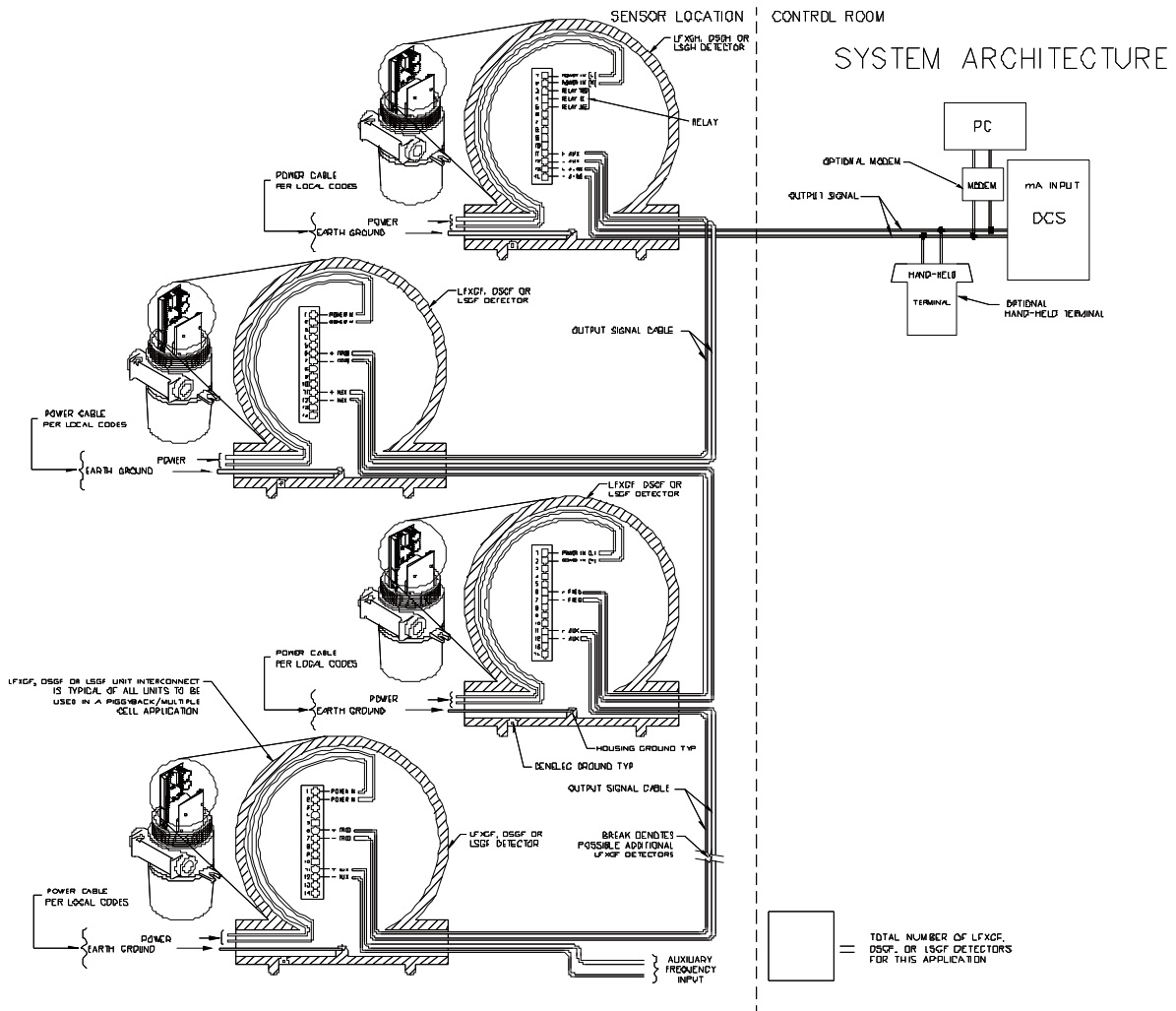


Figure 36: Interconnect—Multiple detector

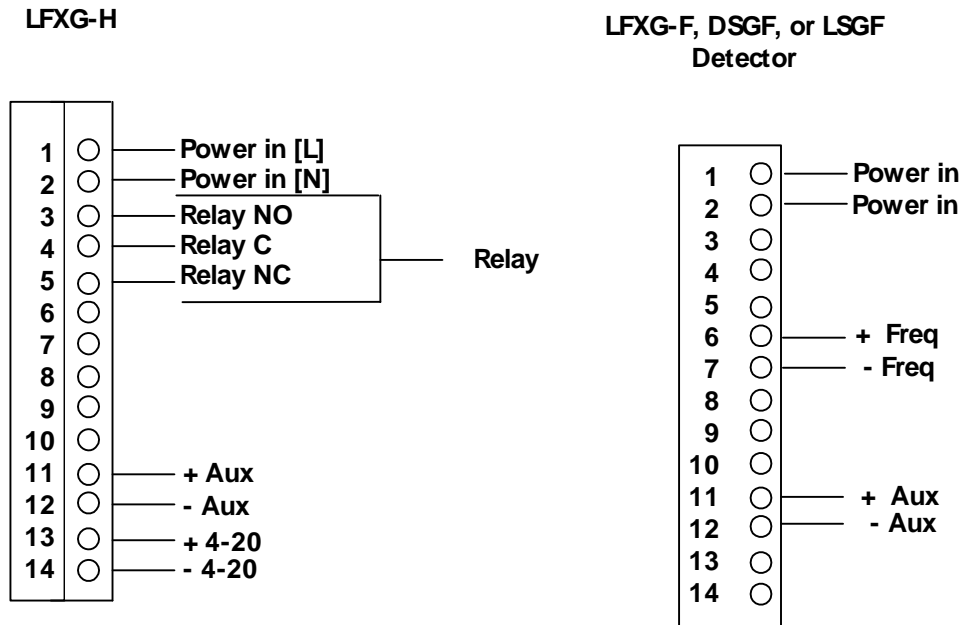


Figure 37: Multiple detector interconnect terminals

Initial settings and calibration requirements

Refer to these sections of this manual for more details:

Table 24: Initial setting and calibration locations

Setting	Manual heading	Page
Select Summation mode in Initial setup	Setting up summation mode	129
Set span for total of all detectors	Span settings	103
Calibrate according to guidelines in calibration chapter	Initial process calibration	31

Setting up summation mode

Procedure 49: Setting up summation mode

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Auxiliary input**
3. From the **Auxiliary input** menu, select **Compensation**

The compensation screen displays the current type of auxiliary input
4. From the **Compensation** menu, select **Type**
6. From the **Type** menu, select **Summation**
7. Press F4 to enter
8. If using a hand-held HART communicator, press F2 to send the settings to the transmitter.

Calibrating with multiple detectors summation

The calibration procedures are the same with one or multiple detectors. The summing of the counts from multiple detectors is invisible to the user.

When setting the span, set it for the length that is the total of all the detectors.

Note: In many cases, you cannot fill or empty the process vessel for calibration. Use the following hints in these situations: With the vessel empty, open the source holder shutter to simulate low level (“set low level”) in software. Close the source holder shutter to simulate high level (“set high level”) in software.)

NORM (naturally occurring radioactive material) compensation

Products that contain natural radioactive materials (for example, radon) may require special compensation of the level measurement. The radiation emitted by the product material can interfere with the measurement, since the detector cannot differentiate between the radiation from the source and the radiation from the product.

Achieve compensation of the measurement by using a second detector that measures only the radiation emitted by the product material. A primary detector measures the process level measurement. The signal from the secondary detector is input to the primary detector. The primary detector runs an algorithm to subtract the effect of the material's radiation from the source holder's radiation.

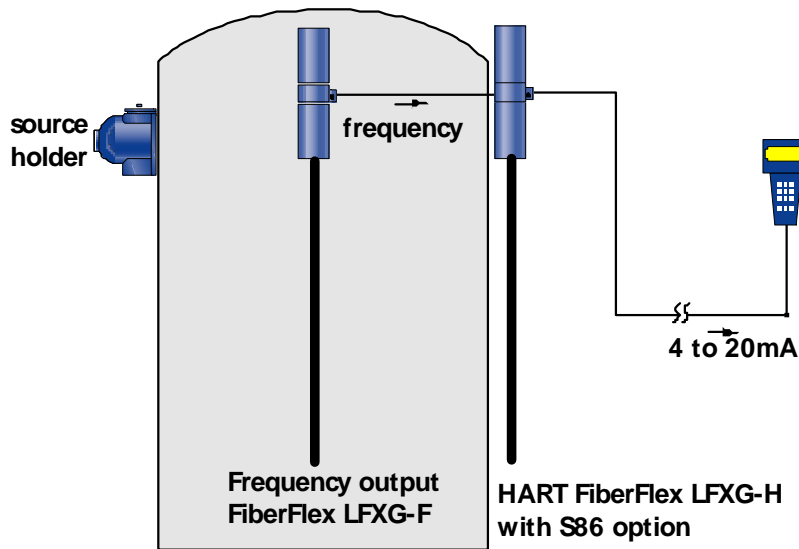


Figure 38: NORM compensation system

Special drawings for NORM Compensation

Ideally, identification of applications requiring NORM compensation occurs at the time of order. The end user, engineering contractor (or both) may have received certified drawings for the exact equipment ordered. Refer to the drawings along with this section of the manual.

Note: If the instruction on the drawings and this manual differ, follow the drawing instructions. They are specific to your order.

Installation requirements

You must install the detectors correctly for NORM compensation to work.

Mount the primary detector so it is in the source holder radiation beam. Mount the secondary detector so that it is NOT in the source holder radiation beam.

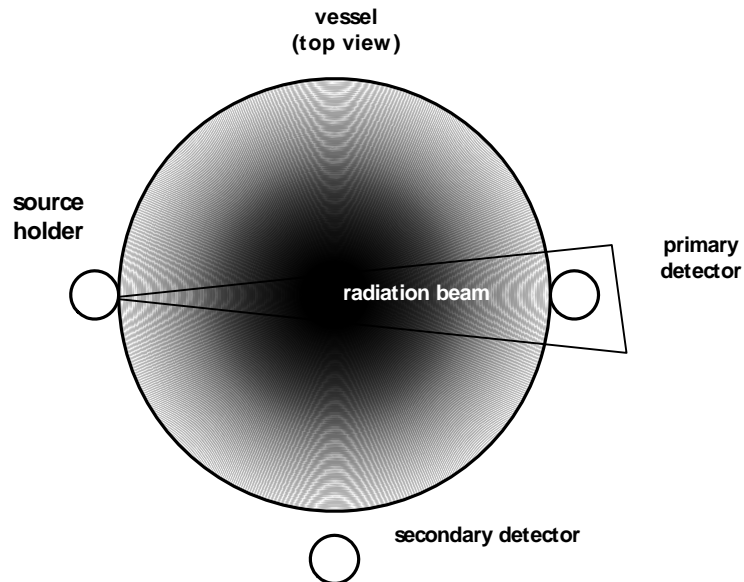


Figure 39: Placement of detectors for NORM compensation

Detector wiring

Wire the secondary detector into the primary detector as shown in Figure 40.

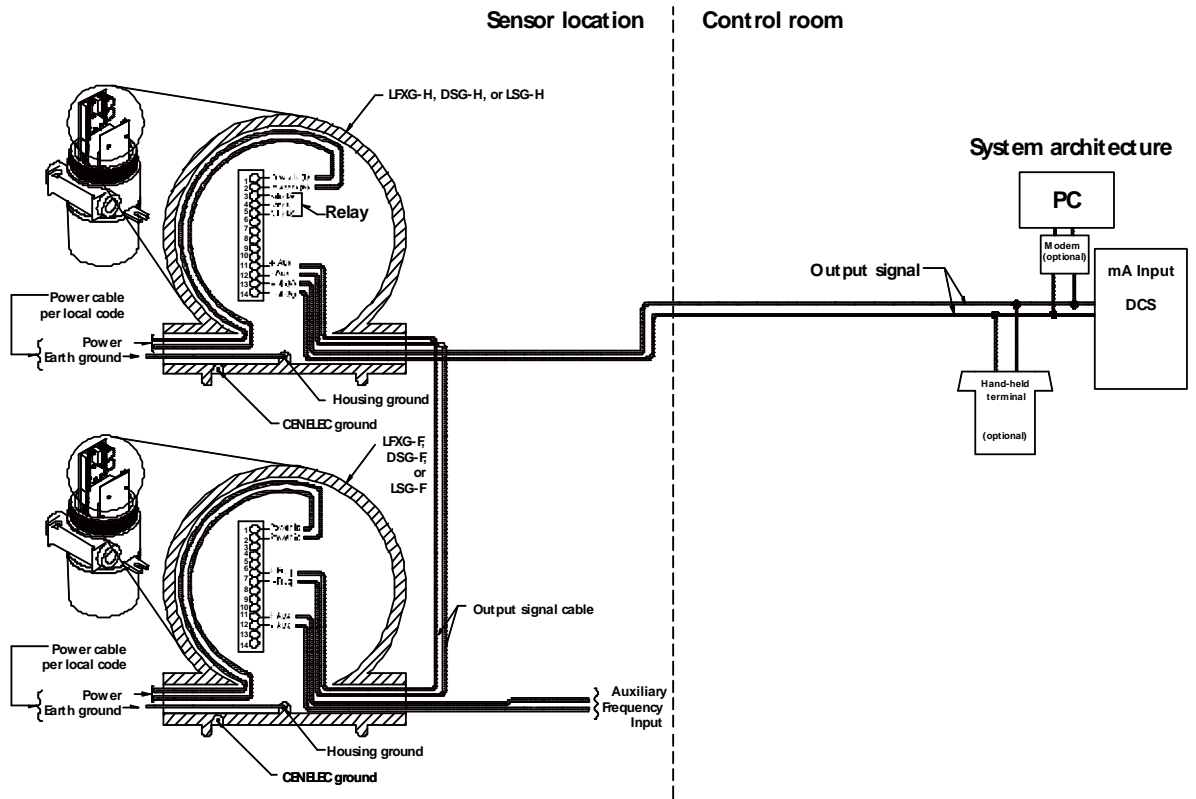


Figure 40: Interconnect— LFXG-F with LFXG-H

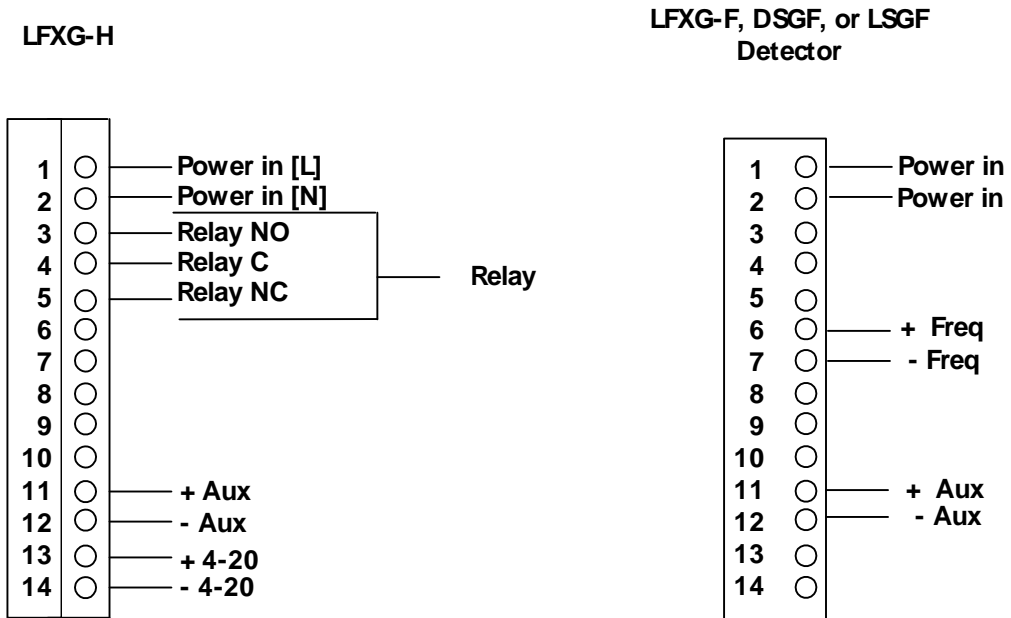


Figure 41: Dual detector interconnect terminals

Initial settings and calibration requirements for NORM compensation

Specific software settings and calibration procedures are required for NORM compensation.

Setting up NORM compensation

Procedure 50: Setting up NORM compensation

1. From the **Main menu**, select **Initial setup**
2. From the **Initial setup** menu, select **Auxiliary input**
3. From the **Auxiliary input** menu, select **Compensation**
The compensation screen displays the current type of auxiliary input.
4. From the **Compensation** menu, select **Type**
6. From the **Type** menu, select **Compensation**
7. Press F4 to enter.
8. If using a hand-held HART communicator, press F2 to send the settings to the transmitter

Calibrating with NORM compensation

Before calibrating, make sure the NORM compensation option is set up. Refer to Procedure 50.

Note: To calibrate the NORM compensation system, you must be able to fill the vessel to the maximum level with radioactive product.

Procedure 51: Calibrating with NORM compensation

1. Set the product level to maximum
2. Turn the source holder shutter to “OFF” (this ensures that the only radiation picked up by the detector comes from the product and not the source)
3. Perform a data collect of the primary sensor
 - From the **Main menu**, select **Calibrations**
 - From the **Calibrations** menu, select **Data collect**
 - Record the value of the counts from the primary data collect.
4. From the **Main menu**, select **Initial setup**
5. From the **Initial setup** menu, select **Auxiliary input**
6. From the **Auxiliary input** menu, select **NORM**
7. From the **NORM** menu, select **Aux data collect**
8. At the prompt, select **Yes** to take data. Record the value of the counts from the Auxiliary data collect
9. From the **NORM** compensation screen, select **Gain**. Adjust the gain value as follows:
 - Compare the counts from the primary and auxiliary data collects
 - If the auxiliary channel data collect counts are higher than the primary sensor data collect counts, adjust the NORM compensation gain down. Select **Yes** to accept the counts and press F4 to enter
 - If the auxiliary counts are lower than the primary counts, adjust the NORM compensation gain up
10. Repeat the auxiliary data collect and gain adjustment steps until the auxiliary channel counts are within +/-10% of the primary sensor counts
11. If using a hand-held HART communicator, press F2 to send the settings to the transmitter
12. Follow the procedures for performing a Two-point calibration and linearizer curve from the Calibration chapter of this manual. These procedures require changing the product level from minimum to maximum and collecting data
13. Complete the linearization and calibration with the procedures “Calculate linearity” and “Calculate calibration”. See pages 49 and 50.

GEN2000 Local RS-485 Network

This feature supports gauging systems that require two or more measurement systems that interact to provide a single compensated measurement.

The RS-485 network has the following gauge types:

- Master
- Responder

The gauges use the half-duplex RS-485 communication network. The gauges transfer specific information between each other in the field with only the master gauge actually communicating with the control room.

The master gauge has the following features:

- Initiates all communication on the network
- Keeps a list of expected gauges on the network and cycles through each gauge requesting a response
- Update the tag, count information from the responder gauges, and track the network health

The responder gauges have the following features:

- Have a unique address for their reply
- Have a table listing other network gauges with information that it requires and the function of that data.
- Can listen to all of the responses of the other gauges, which enables each responder gauge to update the count information from other gauges (if setup to do so)

Installation requirements

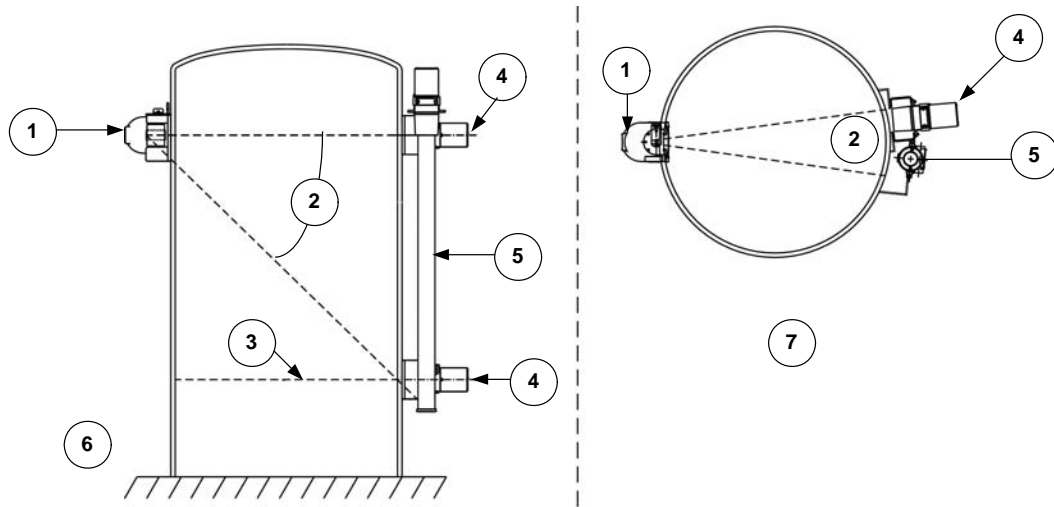


Figure 42: Typical installation—vapor compensation & auto zero

Figure notes:

1. Radiation source holder
2. Radiation beam
3. Minimum process level measured
4. Radiation detector DSG with HART protocol output using RS-485
5. Radiation detector(s) level with HART protocol output using RS-485
6. Side view
7. Top view

Detector wiring

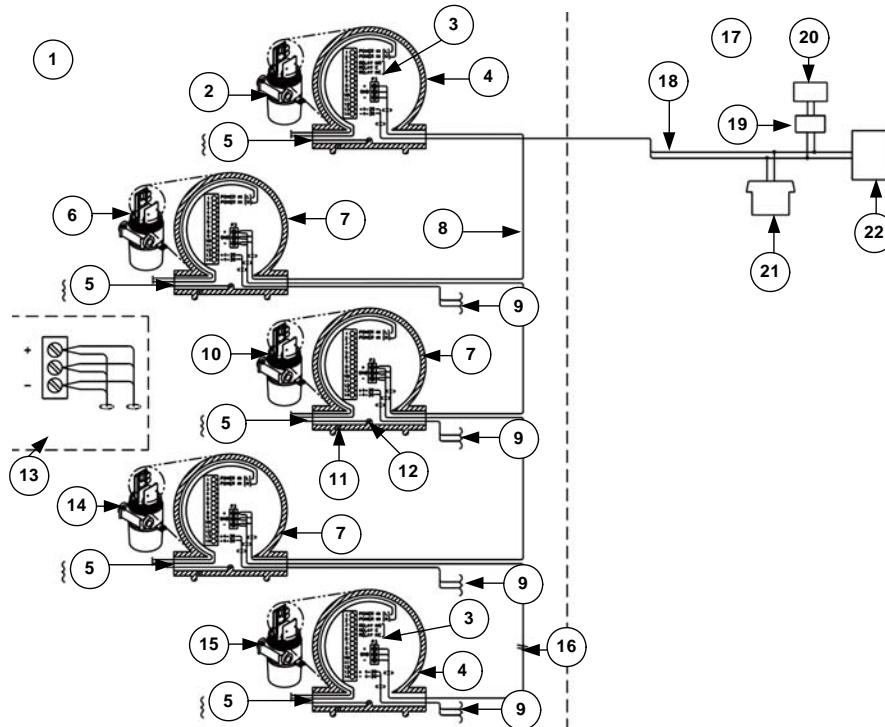


Figure 43: Interconnect—GEN2000 RS-485 multiple detectors/transmitters

Figure notes:

- | | | |
|-----------------------------------|-----------------------------------|--------------------------------|
| 1. Sensor location | 9. 4 ... 20 mA output | 17. Control room |
| 2. High level alarm vapor density | 10. Middle level | 18. 4 ... 20 mA output signal |
| 3. Relay | 11. CENELEC ground | 19. Modem |
| 4. DSGH detector | 12. Housing ground | 20. PC |
| 5. Power/Earth ground | 13. RS-485 connection enlarged | 21. Handheld terminal (option) |
| 6. Top level | 14. Bottom level | 22. mA input DCS |
| 7. LFXG-H or LSGH | 15. Low level alarm auto zero | |
| 8. RS-485 signal cable | 16. Additional detectors (option) | |

Software

To setup the RS-485 network you must have firmware version 2000.30 or 2000.30C or higher, Ohmview 2000 version 2.0.0 or higher, and a HART modem with a connection to a communication port.

The Ohmview 2000 Launcher program has the RS-485 feature. Select this feature to setup the RS-485 network, choose compensation types, and view information about the gauges.

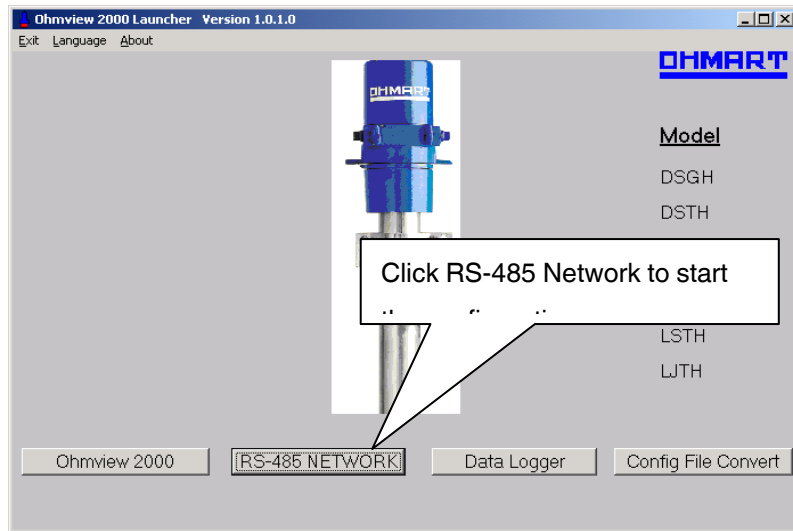


Figure 44: Ohmview 2000 Launcher program

Note: If it does not connect, click Disconnect, click Exit and entirely close Ohmview 2000. Wait for 30 seconds and open the program again using the Launcher program. Select another port. After selecting the proper port with the HART modem, the program remembers the last port used and selects it again.

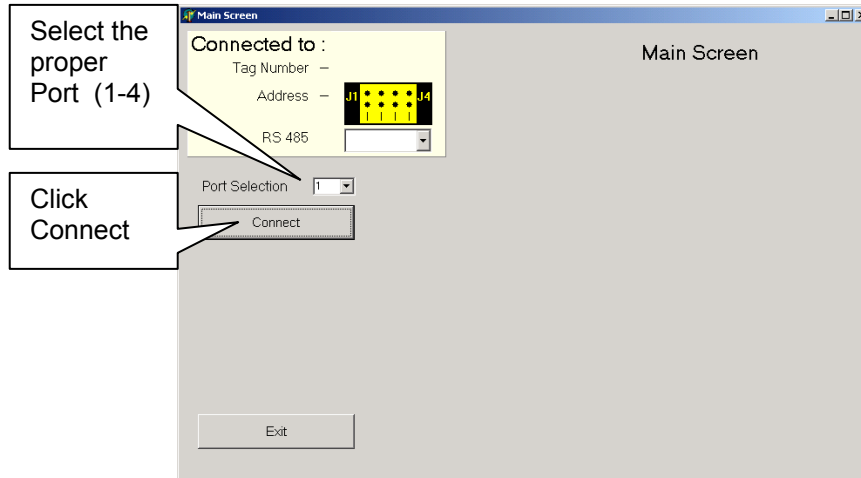


Figure 45: Ohmview 2000 RS-485 main screen

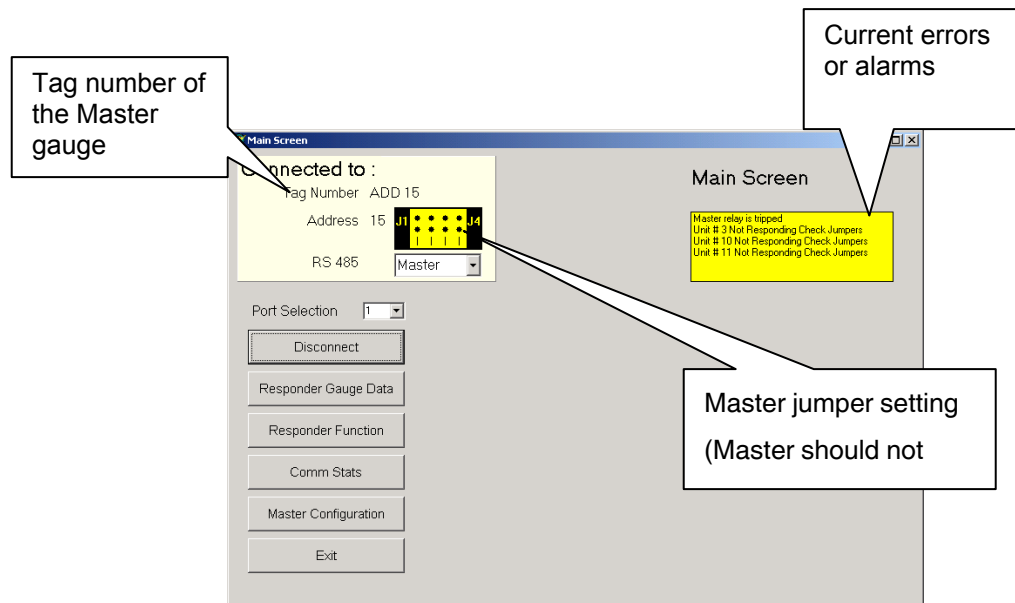


Figure 46: RS-485 Master Main menu screen

The Main menu for the master contains the following selections:

- Connect or Disconnect—Click to connect or disconnect from the gauge
- Responder Gauge Data—see page 144
- Responder Function—see page 145
- Comm Stats—see page 147
- Master Configuration—see page 148
- Exit—Click to exit program

Responder Gauge Data

This screen displays the units and the counts for each Responder gauge as selected. If a unit does not display a count, it has not been set up to do so or is not on the network.

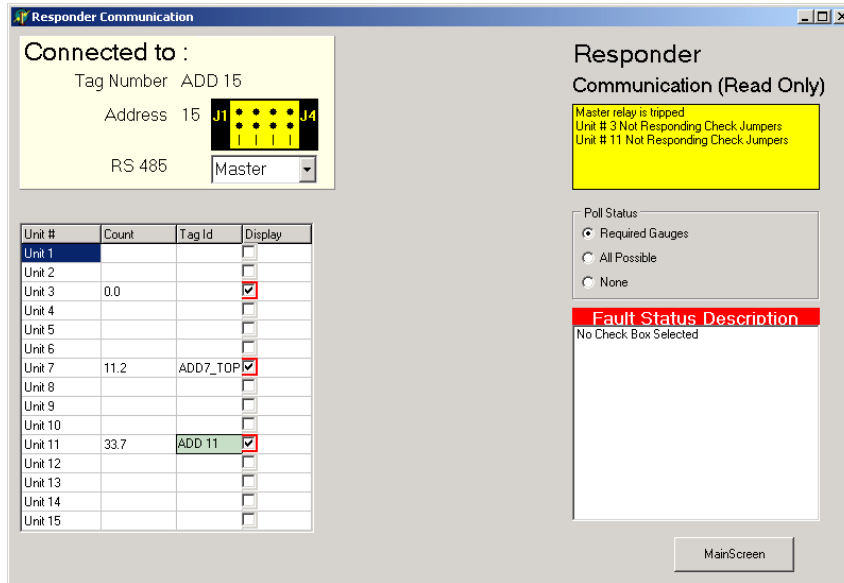


Figure 47: RS-485 Responder gauge data screen

Responder Function

Use this screen to select the function for different units.

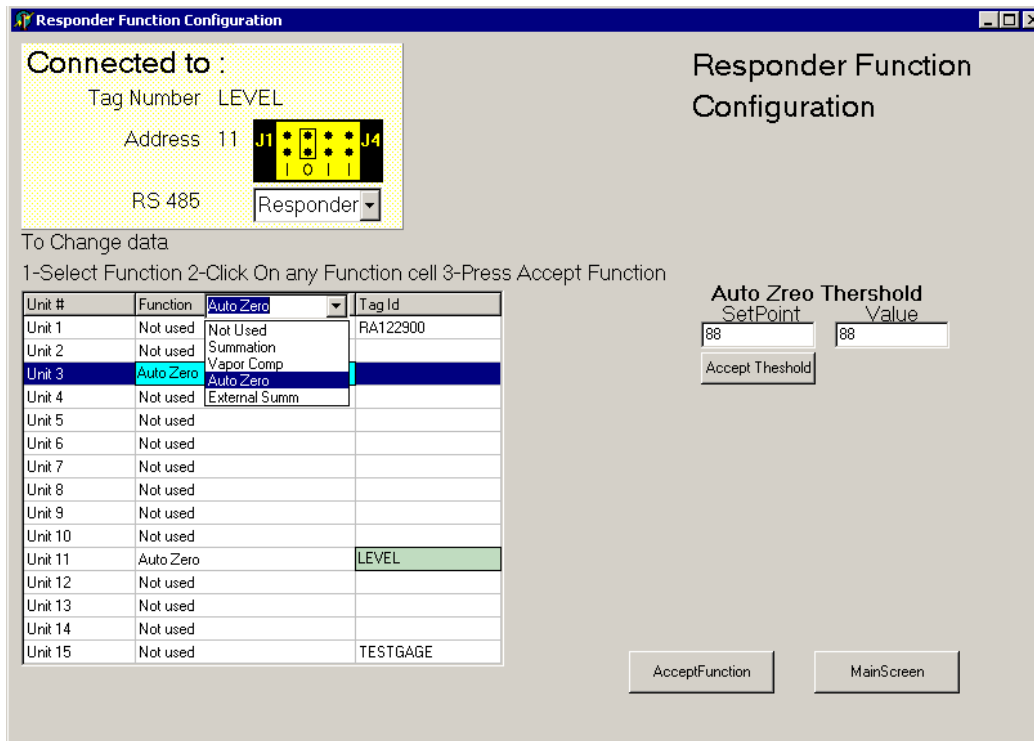


Figure 48: RS-485 Responder Function screen

The functions available for each responder are:

- Not Used
- Summation
- Vapor Comp
- Auto Zero
- External Summation

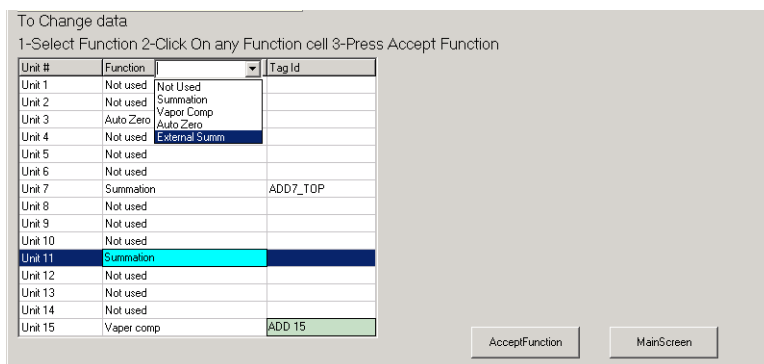


Figure 49: Responder function pull-down menu

To change the function for a unit, perform the following steps:

Procedure 52: Changing the Responder unit function

1. Select the Function cell next to the unit number
2. From the pull-down menu, select the proper function type
3. Click Accept Function

Communication Statistics

Use this screen to view the number of times the Master unit has sent messages to the Responder units and the number of times the responder units have replied.

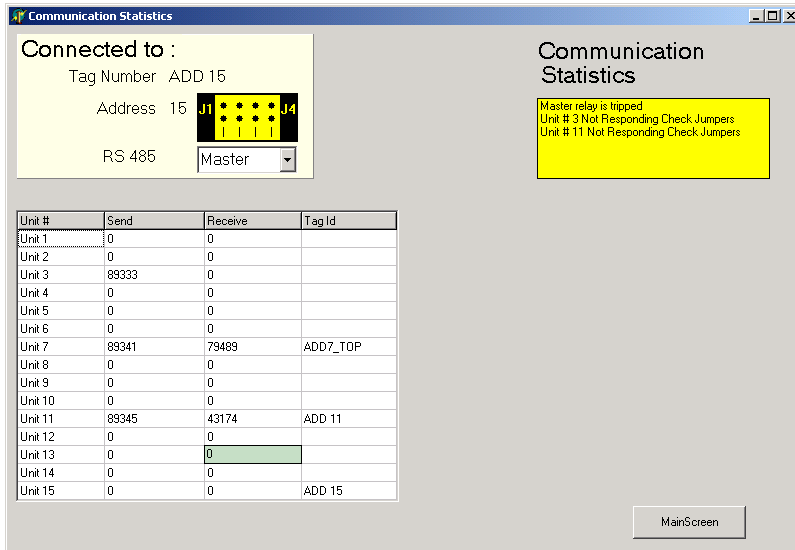


Figure 50: RS-485 Communication Statistics screen

Master Configuration

Use this screen to setup the Polling requirements for each unit. Polling activates the function for the unit.

To turn the polling On or Off, double-click on the Poll cell next to the unit number.

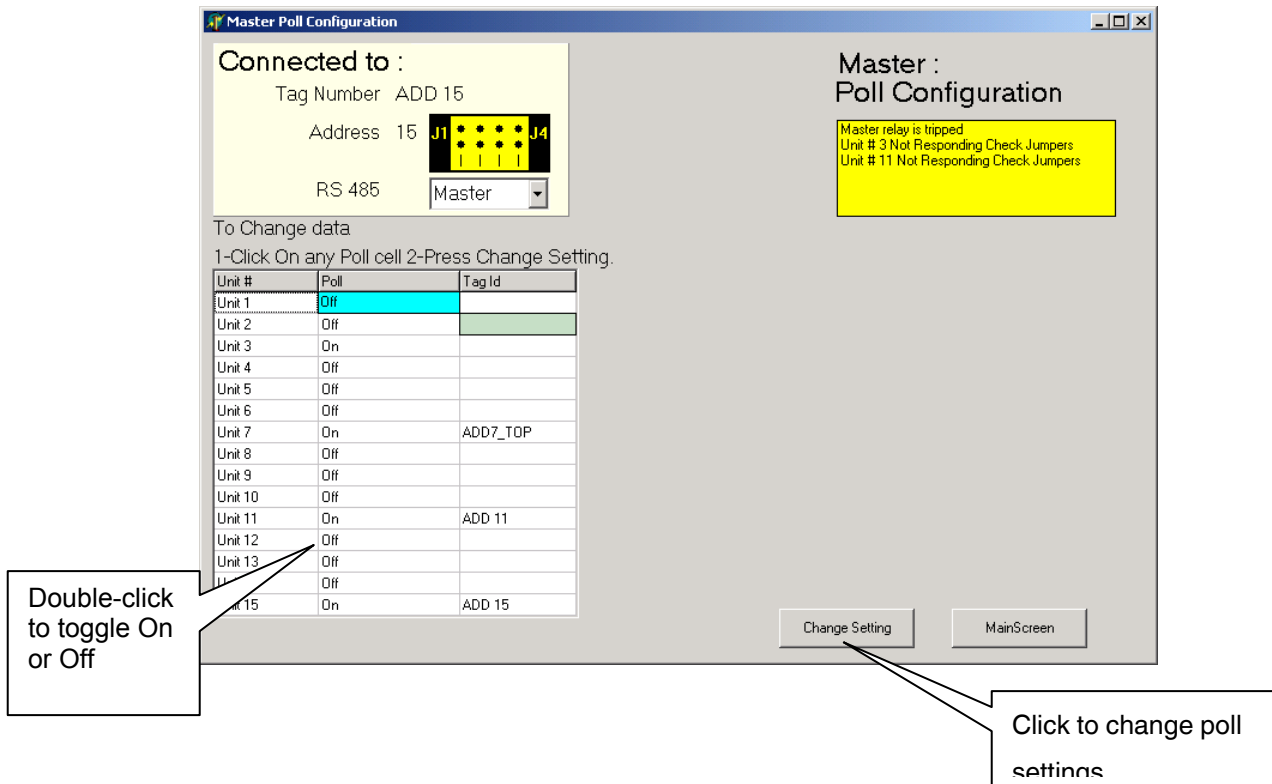


Figure 51: RS-485 Master Configuration screen

Responder Main menu

To setup and test a specific responder unit, connect the HART modem jumpers anywhere along the 4 ... 20 mA output.

Procedure 53: Connecting directly to a Responder

1. Open Ohmview 2000 Launcher
2. Select the communication port number that connects to the HART modem
3. Click Connect

The Responder Main Menu screen displays

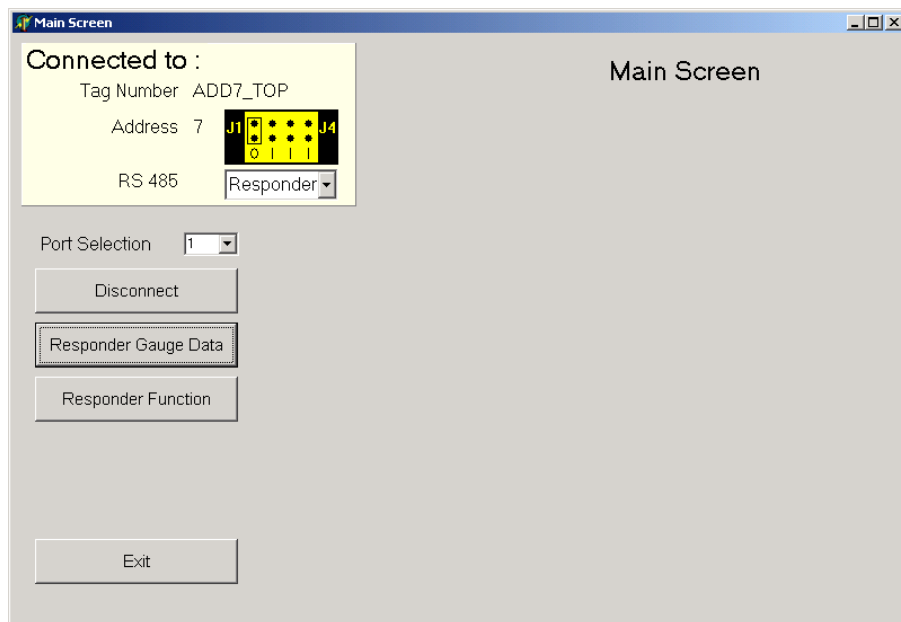


Figure 52: Responder Main Screen

The following choices are available on this menu:

- Responder Gauge Data (see page 144)
- Responder Function (see page 145)
- Connect or Disconnect –Click to connect or disconnect from gauge
- Exit—Click to close program

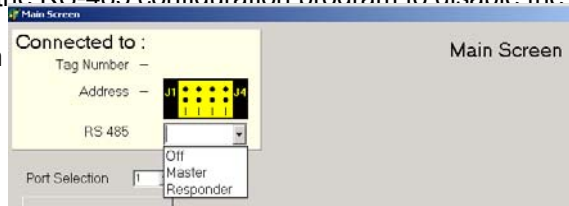
Initial setup

Perform the following steps to set up the GEN2000 RS-485 local network:

Procedure 54: Setting up GEN2000 RS-485 local network

1. Check the wiring connections for power, network and analog output for all gauges
2. Disconnect the RS-485 network from the master gauge
3. Verify that the master gauges has no jumpers made (address F)
4. Power up the master gauge
5. Use the RS-485 configuration program to disable the RS-485 local network

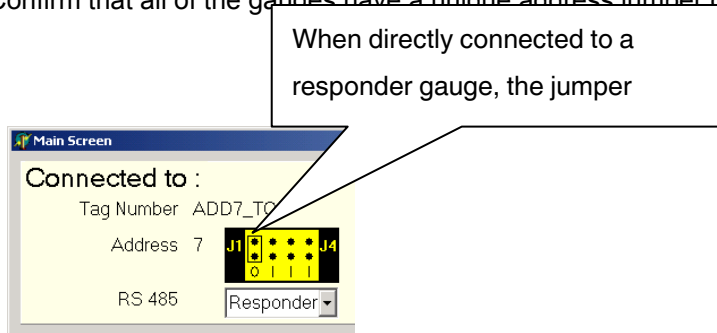
From



6. Re-connect the RS-485 wiring on the master gauge

Note: Wire the Master gauge relay as the RS-485 Network Fault relay. Failure to use this relay can result in significant measurement error from incorrect compensation or no compensation

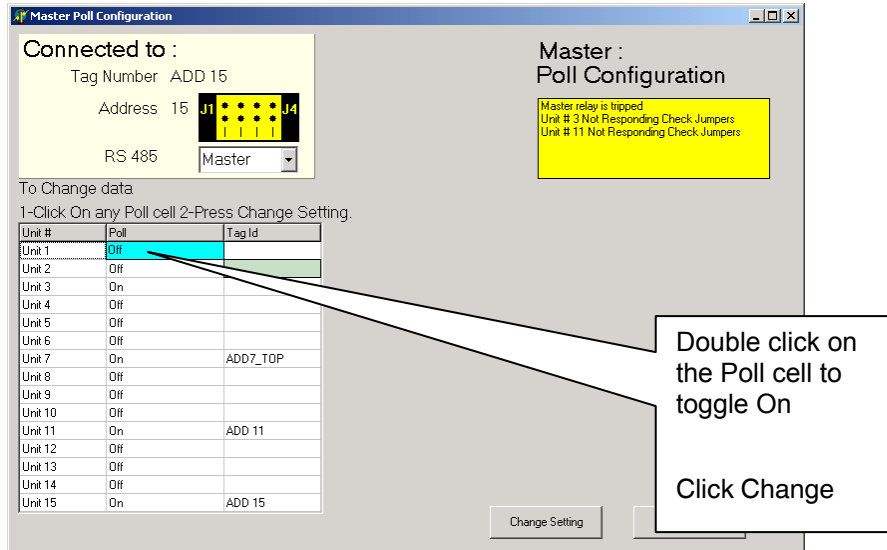
7. Confirm that all of the gauges have a unique address jumper configuration



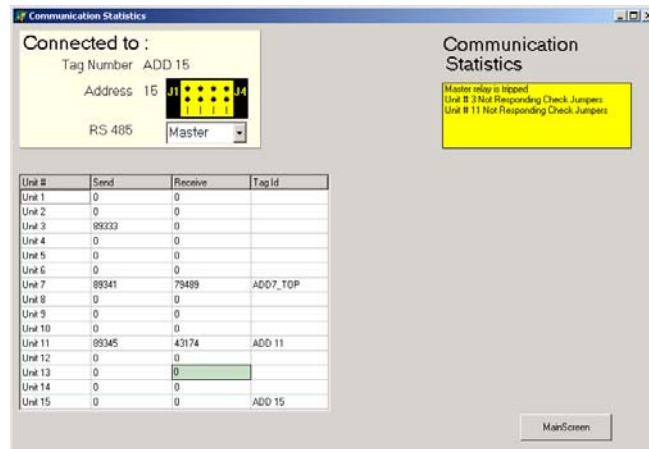
8. Power up all network gauges
9. Confirm all hardware is functioning properly

Procedure 54: Setting up GEN2000 RS-485 local network (continued)

- Run the RS-485 configuration program and configure the master gauge to poll all of the gauges on the network



- Verify all gauges are communicating as expected



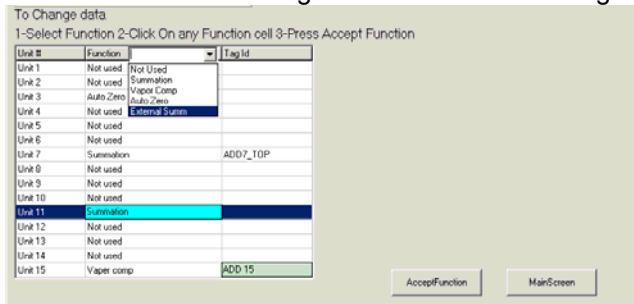
- Populate the master table to continuously poll all gauges
- Enable the RS-485 local network using the configuration program – continuous communication starts

Procedure 54: Setting up GEN2000 RS-485 local network (continued)

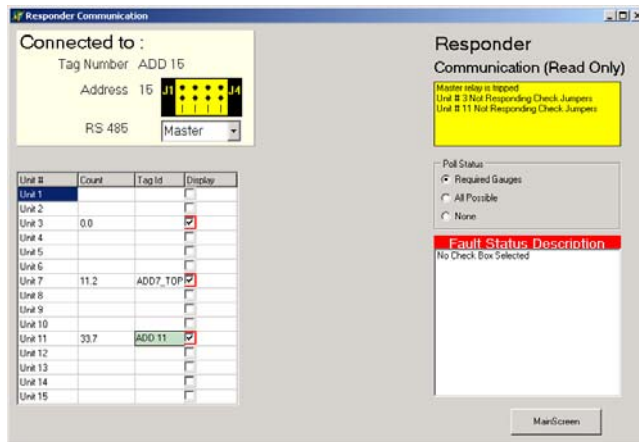
- Continue to monitor the RS-485 network to verify that all of the gauges are responding as expected and that the relay is not in an alarm condition

15. For each gauge on the RS-485 local network:

- Use the RS-485 Configuration software to configure the Responder table



- Verify that the Responder table contains all of the units required for the particular gauge
- Verify the Responder table is updating



16. Connect to each gauge using Ohmview 2000 and setup each gauge for the particular application. Access the Ohmview 2000 electronic manual under Help for further information on setting up the gauge.

Auto Zero feature

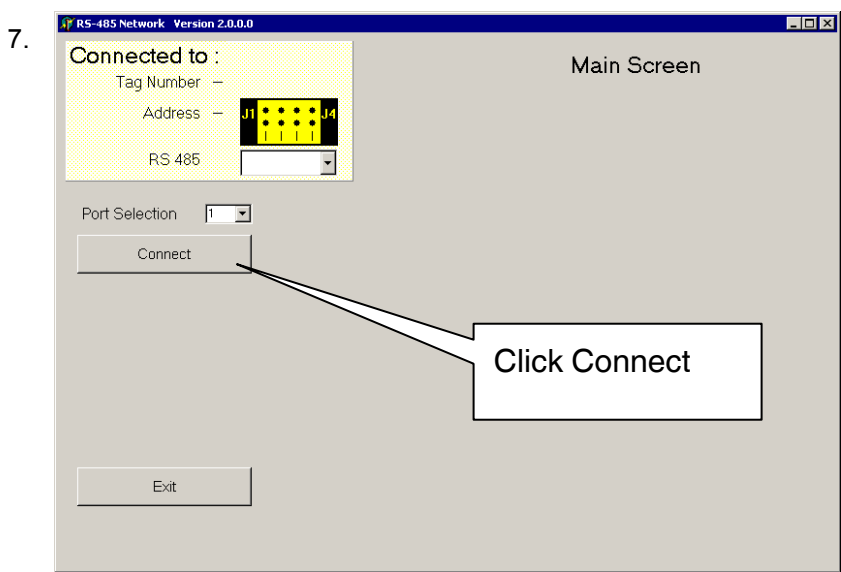
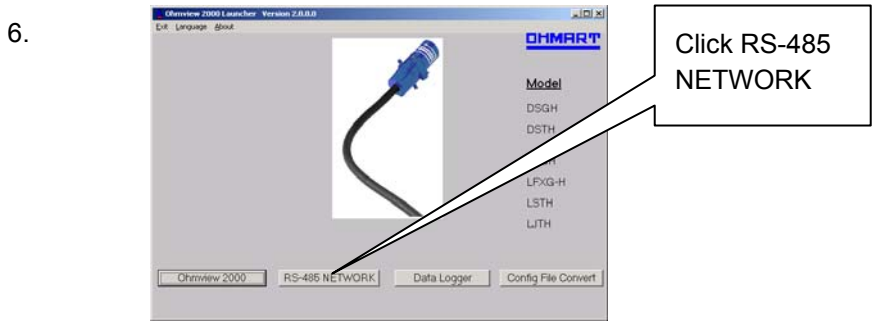
Use this feature with the RS-485 network to provide data to the primary level gauge. The counts feed into the level gauge from the low point indicator on the vessel. When the level gauge senses a preset threshold value, it implements the Auto Zero feature. This feature resets the zero point.

Setting up the Auto Zero feature

To enable this feature using Ohmview 2000's RS-485 Network program, you must have firmware 2000.30 or 30C or higher for GEN2000 instruments.

Procedure 55: Setting up GEN2000 RS-485 local network

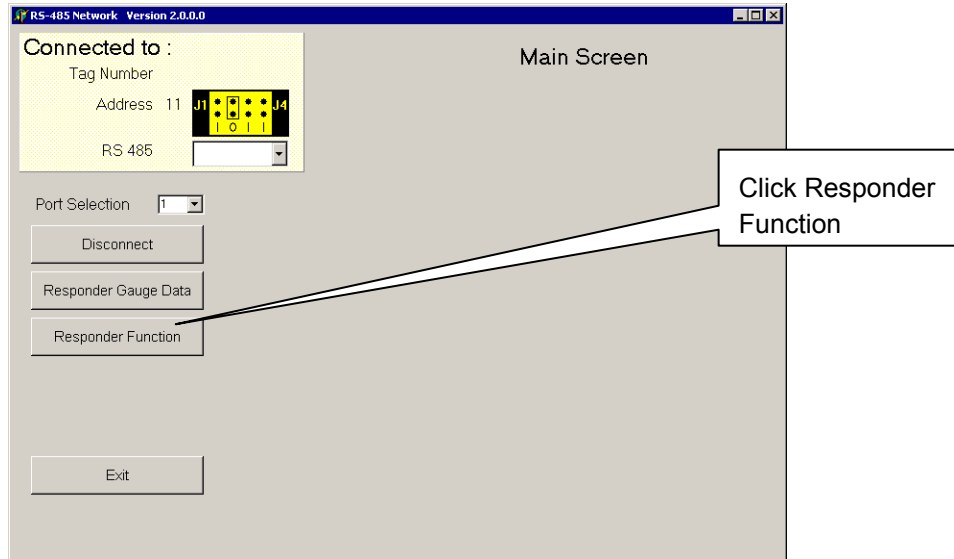
1. Determine the gauge and unit number for your point level indicators
2. Fill the vessel until the process is just above the low process indicator and record the count
3. Fill the vessel until the process is just below the low process indicator and record the count
4. Calculate the 50% level of the two count totals. This number is your auto zero threshold
5. Open the OHMVIEW 2000 Launcher program



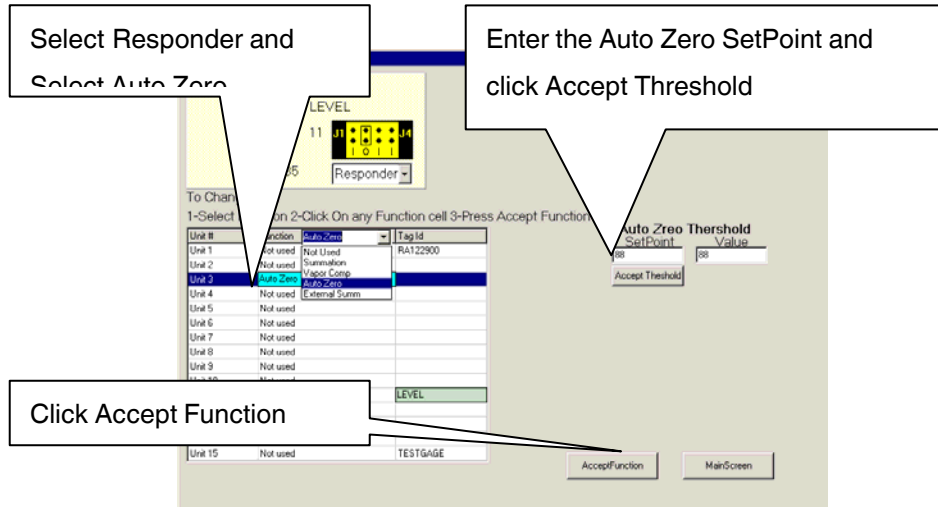
This connects to the gauge that attaches to your HART modem

Procedure 55: Setting up GEN2000 RS-485 local network (continued)

8.



9.



10. The Auto Zero feature is enabled.

Vapor pressure compensation

A nuclear level gauge works on the principle that the product shields the detector from the radiation beam, allowing more or less radiation to strike the detector as the product level falls and rises. For an accurate level indication, the variation in the detector output should depend only on the product level.

However, vapor pressure variations in the headspace of the vessel can cause erroneous product level indications. This is because the vapor also blocks some of the radiation. When the pressure is higher, more radiation is blocked; when the vapor pressure is lower, less is blocked. Therefore, even at the same product level, the detector can receive varying amounts of radiation, depending on the head vapor pressure.

You can compensate for this by using a point detector (model DSGH) to separately measure the radiation passing through the vapor space. This detector signal and the signal from the continuous level detector combine to eliminate the effect of the vapor pressure on the level indication.

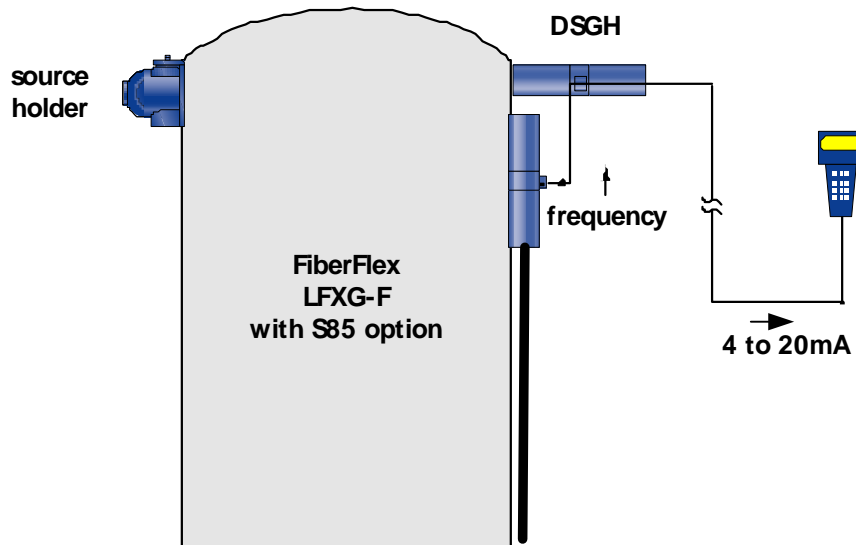


Figure 53: Vapor compensation system

Installation requirements

A vapor compensation system requires two detectors: the point detector (model DSGH) to measure the vapor space, and the continuous level detector to measure the product level.

Both must be in the radiation beam from the source holder. Mount the DSGH so that it is above the highest expected product level.

Detector wiring

The level detector provides a frequency signal to the DSGH. The output of the DSGH is the calibrated, vapor compensated, 4 ... 20 mA signal for control and HART communication. Figure 54 illustrates the interconnection between the density gauge and the level gauges.

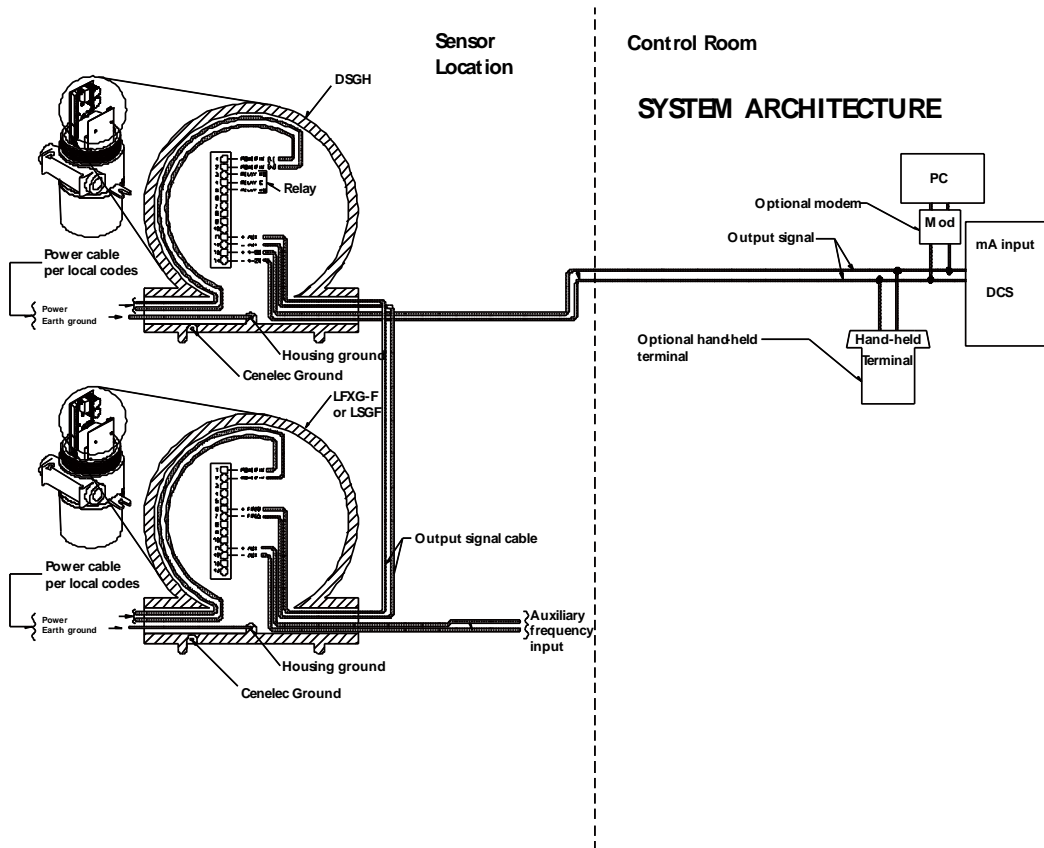


Figure 54: Interconnect DSGH with LFXG-H

Algorithm for vapor comp

The vapor compensation algorithm adjusts the percent span based on a percent change in vapor density from a reference density. (Refer to the Calibration chapter for a complete discussion of continuous level gauge calibrations.)

Each time the gauge computes a level measurement, a new Cal low counts value calculates, which changes the percent span. The algorithm for calculating the cal low counts is:

$$\text{New cal low counts} = \text{cal low counts} * (1 - (\text{vc gain} * \% \text{ change in vapor density counts}))$$

Where:

$$\% \text{ change in vapor density counts} = (\text{reference counts} - \text{vapor density counts}) / \text{reference counts}$$

Variable definitions

Reference counts

Reference counts are counts from DSGH at reference pressure condition (determined during first step of calibration).

Vapor density counts

Vapor density counts are counts from DSGH at current pressure condition.

VC gain

VC gain is the vapor compensation gain (user enters value during calibration)

Initial settings and calibration for vapor comp

Setting up vapor compensation

Procedure 56: Setting up vapor compensation

1. Perform the following steps to set the DSGH up as a level gauge:
 - From the Main menu, select Advanced Fxns
 - From the Advanced Fxns menu, choose Select Gage type
 - From the Select Gage type menu, select Level
 - Press F2 to send to the transmitter
2. Return to the **Main menu**
3. Perform the following steps to select Vapor compensation:
 - From the **Main menu**, select **Auxiliary input**
 - From the **Auxiliary input** menu, select **Compensation**
 - From the **Compensation** menu, select **Type**
 - From the **Type** menu, select **Vapor**
 - Press F4 to enter. You return to the **Compensation** menu
4. Return to the **Auxiliary input** menu.
5. From the **Auxiliary input** menu, select **Filter TC**
6. Set the filter time constant. For best response, this value should be five seconds. If this value is too large (>10sec), the system response slows, with long settling times on the final output
7. From the **Compensation** menu, select **Vapor**
8. From the **Vapor** menu, select **Gain**
 - Set the Gain to 1.0
 - You adjust it again during the calibration procedure
9. If using a hand-held HART communicator, press F2 to send the settings to the transmitter.

Calibrating with vapor compensation

Before calibrating, make sure the vapor compensation option is set up (see Procedure 56).

Note: To calibrate the vapor pressure compensation system, you must be able to adjust both the product level and the vapor pressure.

Calibrating with vapor compensation

Procedure 57: Calibrating with vapor compensation

1. Set the vapor pressure to a typical pressure (this is the reference pressure). At this point, the product level is not important, as long as the density gauge is not blocked by the product
2. From the **Main menu**, select **Initial setup**
3. From the **Initial setup** menu, select **Auxiliary input**
4. From the **Auxiliary input** menu, select **Vapor**
5. From the **Vapor** menu, select **Aux data collect** (This determines the reference counts for the vapor compensation algorithm.)
6. At the prompt, select **Yes** to take data.

When data collection is complete, select **Yes** to save the vapor pressure reference counts
7. If using a hand-held HART Communicator, press F2 to send the settings to the transmitter
8. Return to the **Main menu**
9. Follow the procedures for performing a Two-point calibration and linearizer curve from the Calibration chapter of this manual.
 - These procedures require changing the product level from minimum to maximum and collecting data
 - During the calibration and linearization procedure, maintain the reference pressure in the headspace
10. Complete the linearization and calibration with the procedures “Calculate linearity” and “Calculate calibration”. See pages 49 and 50
11. Set the product to the lowest possible level while at the maximum pressure

Procedure 55: Calibrating with vapor compensation (continued)

12. Set the vapor density to its highest possible value
13. Note the level indication (it will likely be upscale)
14. From the **Initial setup** menu, select **Auxiliary input**
15. From the **Auxiliary input** menu, select **Vapor**
16. From the **Vapor** menu, select **Gain**
17. Adjust the vapor compensation gain value until the level indication reads the correct, minimum level value
18. Press F2 to send to the transmitter.

Internal heater kit for applications requiring a –50 °C rating

A heater kit option is available for the LFXG-H for applications that require a –50°C (–58 °F) temperature rating. With the heater option, the internal temperature of the unit rises approximately 30 °C (54 °F) degrees.

The features of the heater are as follows:

- The heater kit does not affect the functionality of the LFXG-H in any way. There is no requirement for special firmware
- The factory installs the internal heater kit if you order it with the LFXG-H
- Retrofits are available for previously installed equipment
- Three different kits are available, one for 115VAC, one for 220VAC, and one for 24VDC. The part numbers are shown below:

Table 25: Heater kit part numbers

Heater kit power	VEGA Part Number
115 VAC	240723
220 VAC	240724
24VDC	241912

Changes to specifications

The power rating changes from the specifications on page 5 of this manual when you install the heater kit on the LFXG-H.

With the installation of the heater, the maximum power consumption increases to 25W.

The unit is either 115VAC±10% or 220VAC±10% instead of the standard 90–270VAC range or 24VDC.

Notes

Appendix III: Preserving information from SmartPro to the LFXG-H

This appendix describes how to preserve information from an existing level gauge to the LFXG-H.

Preserving information from SmartPro

If you have existing Smart Pro electronics (Smart Pro or Smart Pro Pac), you can preserve information on setup and calibration from the Smart Pro electronics. This information can transfer to the new transmitter electronics, saving a great deal of time commissioning the gauge.

Note: Smart 1 and Smart 2 electronics users can preserve the information from their systems and transfer it to the HART electronics. We recommend consulting VEGA Field Service for help on your individual installation.

Note: EDS users cannot transfer information to the HART electronics. You must perform new setup and calibration procedures.

After the new electronics are installed, refer to “Appendix I: Initial Factory Setup” to enter the correct parameters. Proceed to the “Calibration” chapter for instructions to calibrate the gauge.

Appendix III: Retrofitting HART electronics

Use the following table to record data from the Smart Pro:

Table 26: Smart Pro data record

Smart Pro parameter	Smart Pro screen/item	Value	Corresponding HART parameter
Standardize parameter	520/25		-
Standardize parameter	520/26		-
Process low value (Low sample input)	520/32		Cal low level
Process high value (High sample input)	520/33		Cal high level
Cal low counts	520/39		Counts low
Cal high counts	520/40		Counts high
Time constant	527/0		Filter
Fast response filter (chronrol)	527/1		Threshold
Span	527/2		N/A
Output min	527/10		4 mA level
Output max	527/11		20 mA level
Linearizer curve On/Off	528/41		N/A
Low product value	528/42		Min level
High product value	528/43		Max level

Use Table 27 to record the linearizer table information. Transferring this information makes a new initial calibration procedure unnecessary. (If you prefer to do a new initial calibration, refer to the Calibration chapter of this manual for instructions.)

To calculate the new value to enter into the HART version linearizer table, divide the Smart Pro value of each point by 100. For example, if the Smart Pro value of point 2 is 630, enter 6.30 as the corresponding HART 5.0% point.

Table 27: Linearizer record

Linearizer table points	Smart Pro Screen/item	Smart Pro Value	HART Linearizer table point (%span)	HART Linearizer table (Smart Pro Value ÷ 100)
0	528/0		0.0%	
1	528/1		2.5%	
2	528/2		5.0%	
3	528/3		7.5%	
4	528/4		10.0	
5	528/5		12.5	
6	528/6		15.0	
7	528/7		17.5	
8	528/8		20.0	
9	528/9		22.5	
10	528/10		25.0	
11	528/11		27.5	
12	528/12		30.0	
13	528/13		32.5	
14	528/14		35.0	
15	528/15		37.5	
16	528/16		40.0	
17	528/17		42.5	
18	528/18		45.0	
19	528/19		47.5	
20	528/20		50.0	
21	528/21		52.5	
22	528/22		55.0	
23	528/23		57.5	
24	528/24		60.0	
25	528/25		62.5	
26	528/26		65.0	
27	528/27		67.5	
28	528/28		70.0	
29	528/29		72.5	

Table 33: Linearizer record (continued)

Linearize r table points	Smart Pro Screen/item	Smart Pro Value	HART Linearizer table point (%span)	HART Linearizer table (Smart Pro Value ÷ 100)
30	528/30		75.0	
31	528/31		77.5	
32	528/32		80.0	
33	528/33		82.5	
34	528/34		85.0	
35	528/35		87.5	
36	528/36		90.0	
37	528/37		92.5	
38	528/38		95.0	
39	528/39		97.5	
40	528/40		100.0	

Appendix IV: HART menus and screens

The following charts illustrate the HART hand-held communicator menus and screens. See the “VEGA View User Manual” for illustrations of the VEGA View HART menus and screens.

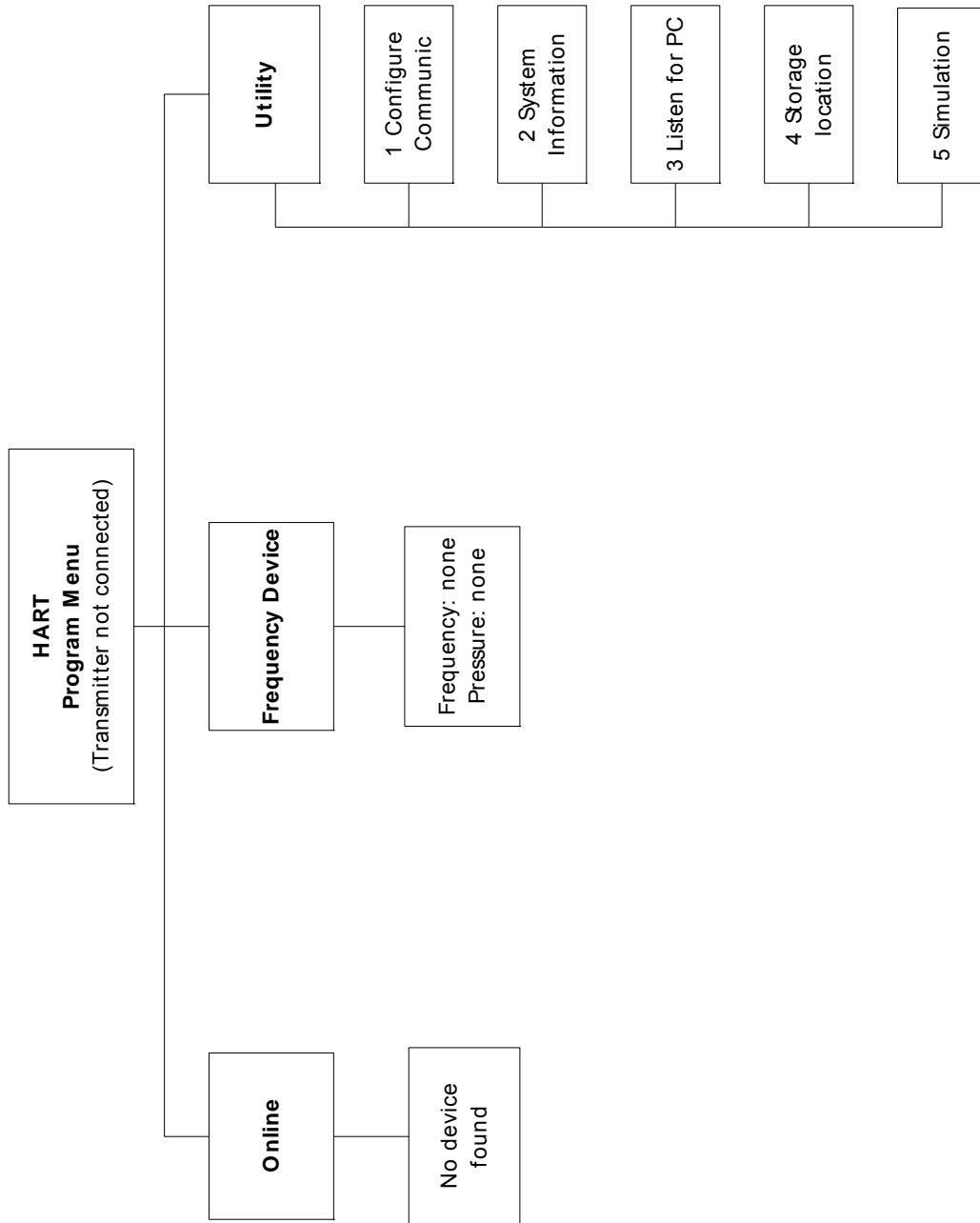


Figure 55: HART screen—Transmitter not connected

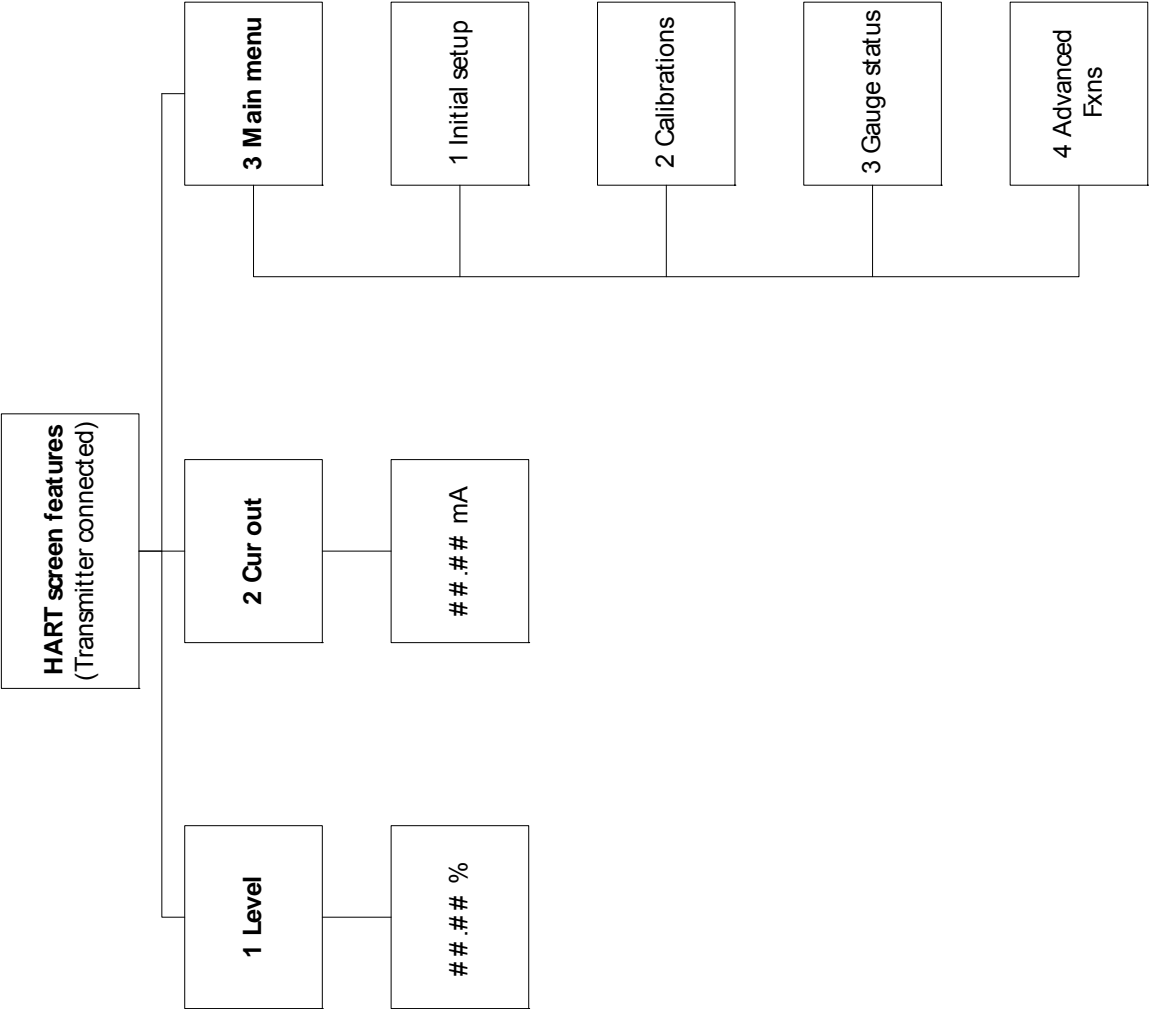


Figure 56: HART screen—Online

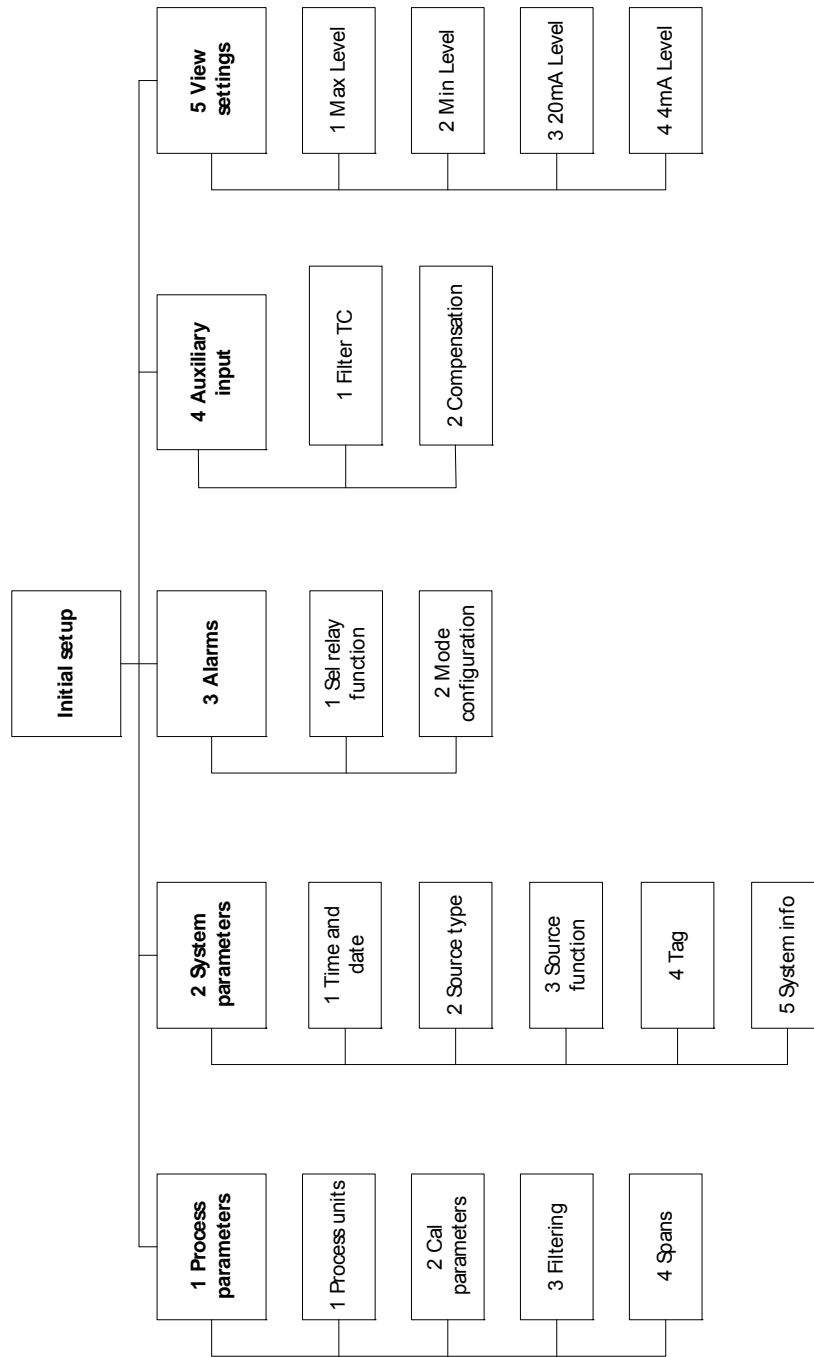


Figure 57: Initial setup

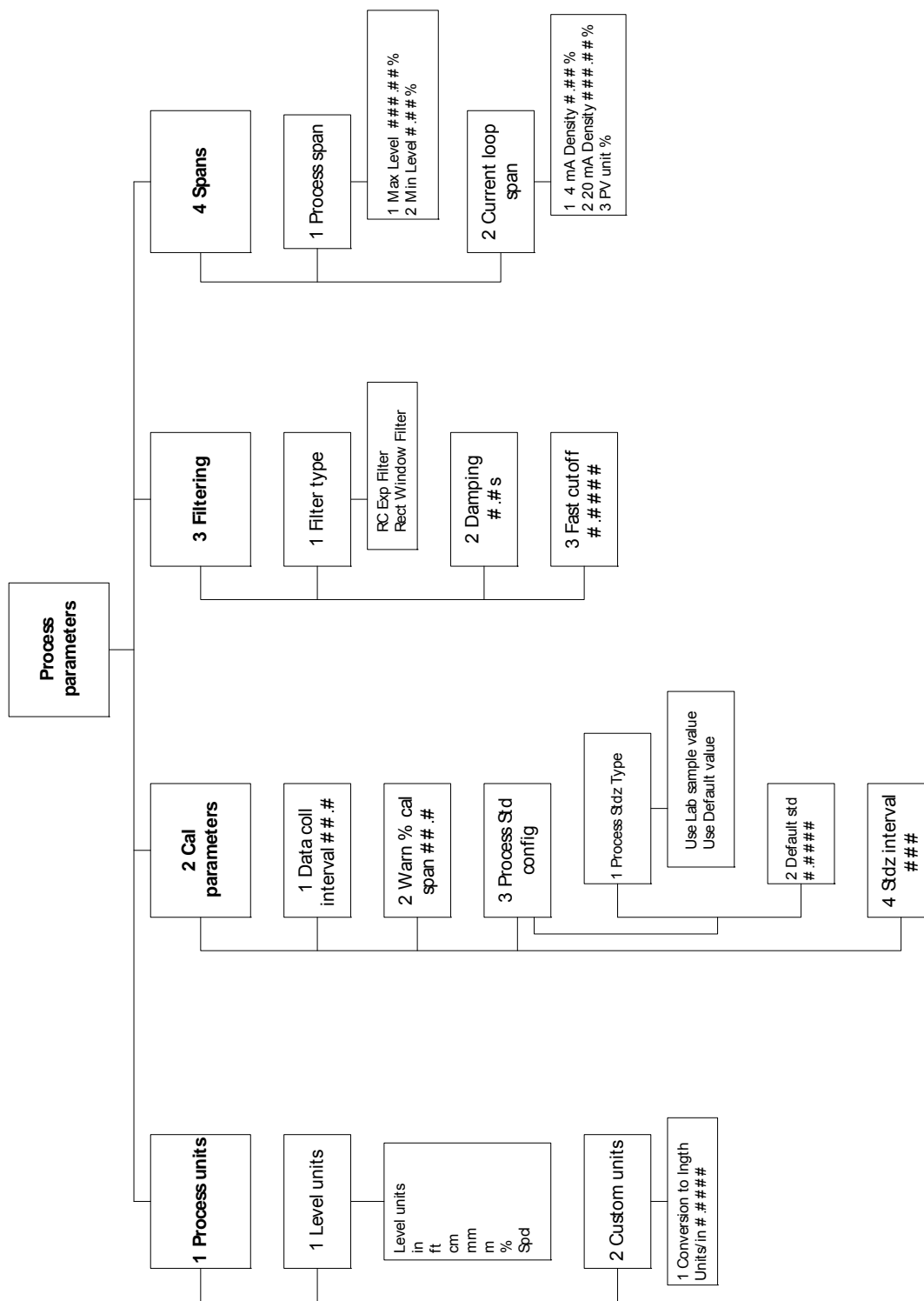


Figure 58: Process parameters

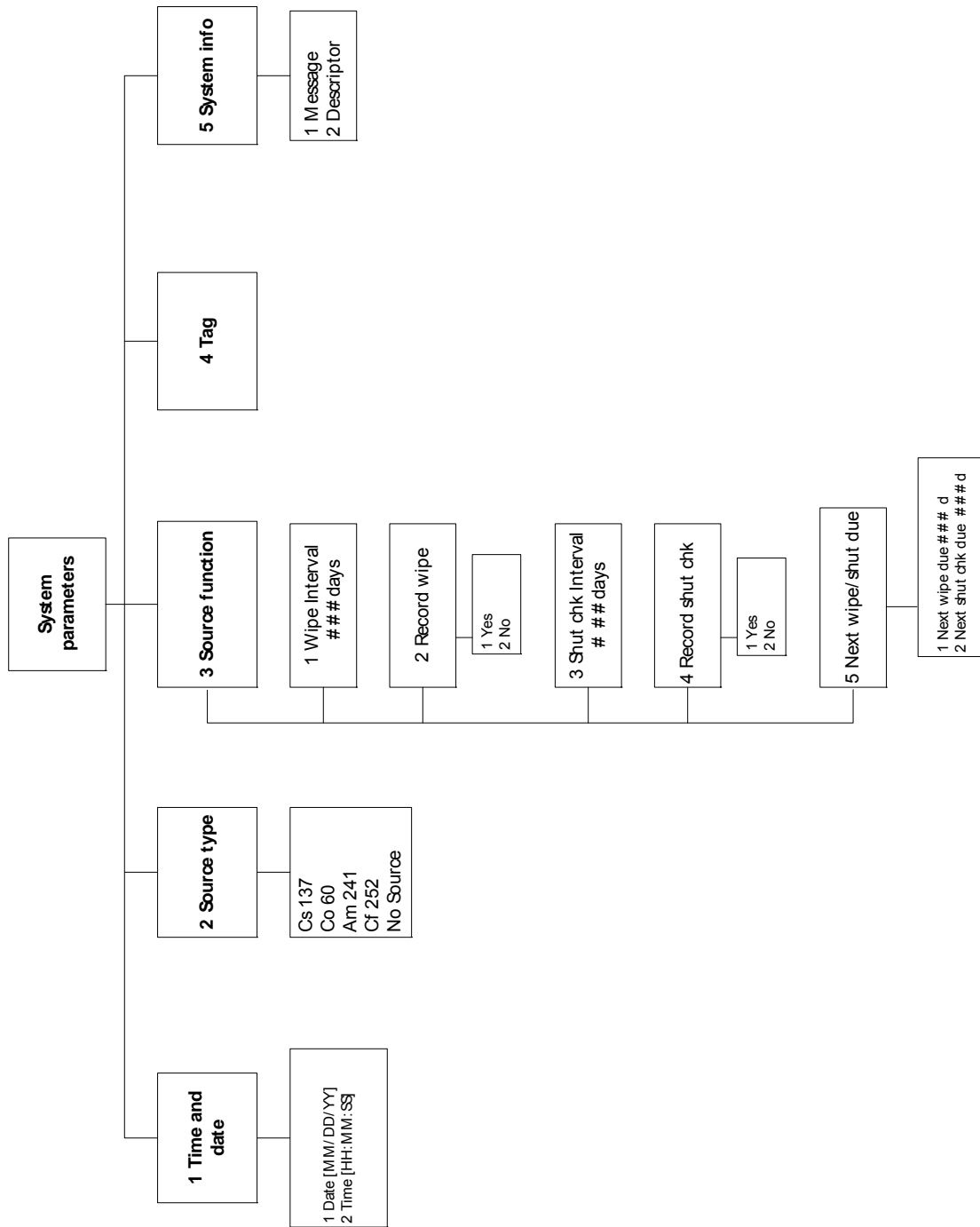


Figure 59: System parameters

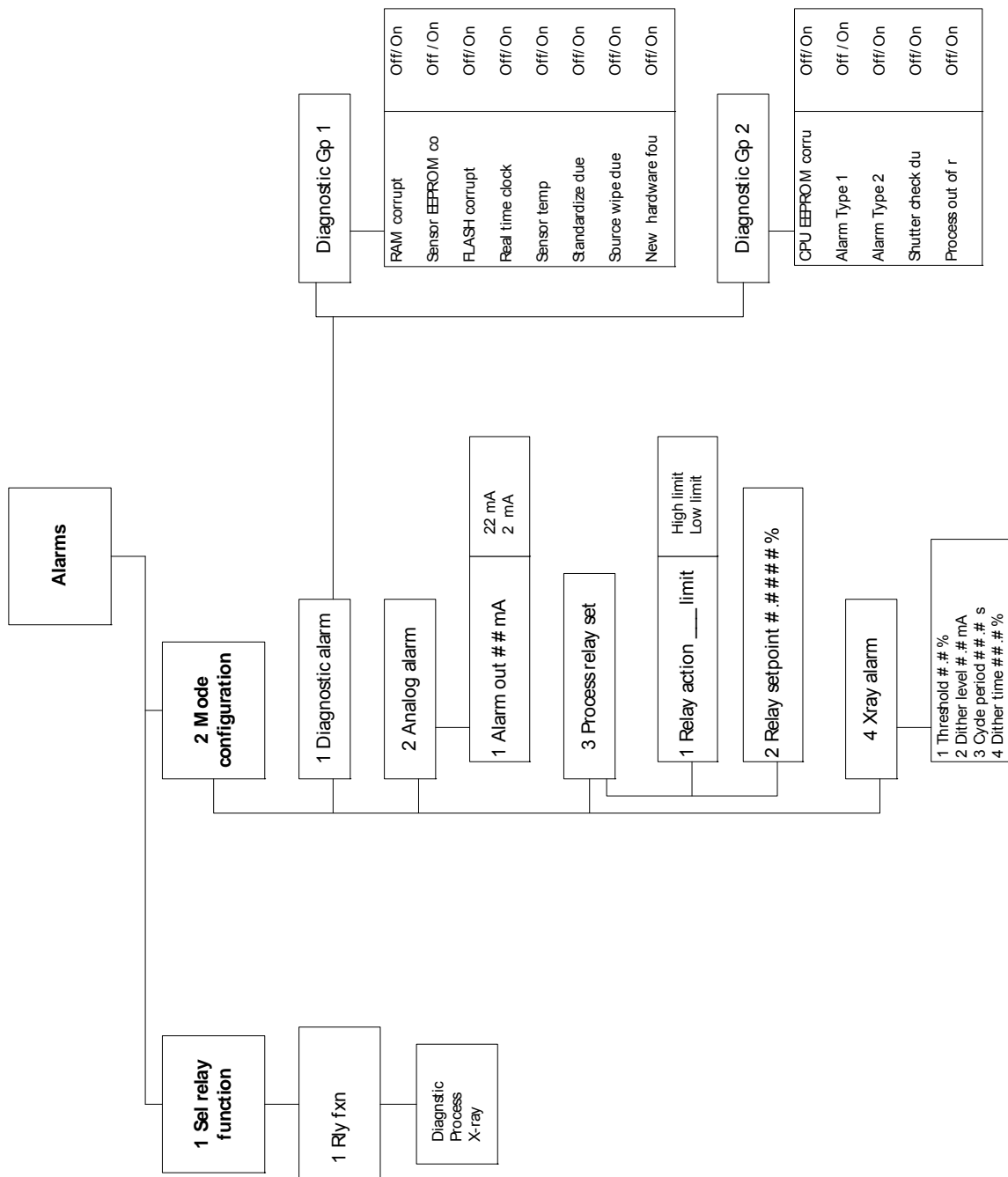


Figure 60: Alarms

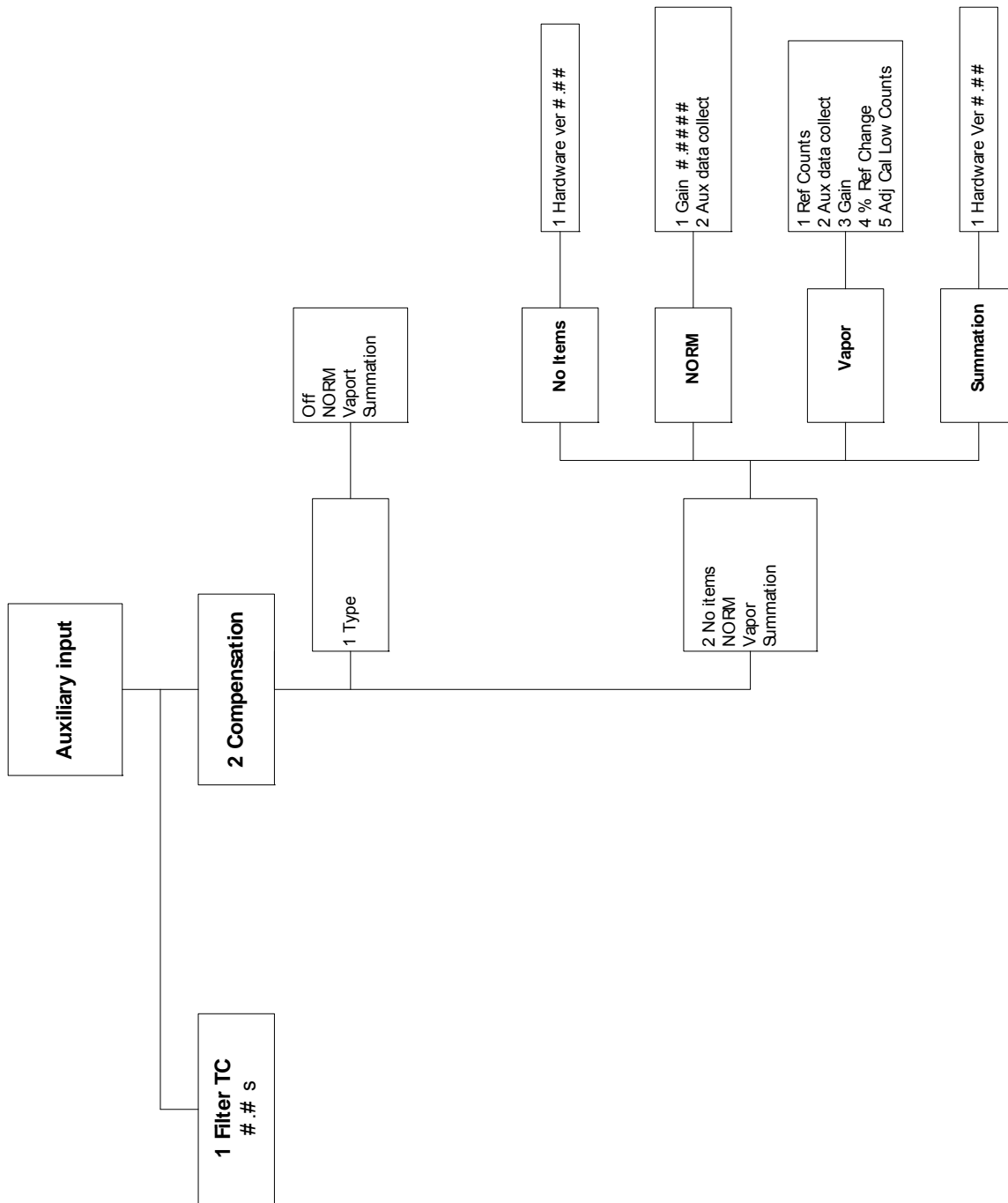


Figure 61: Auxiliary input

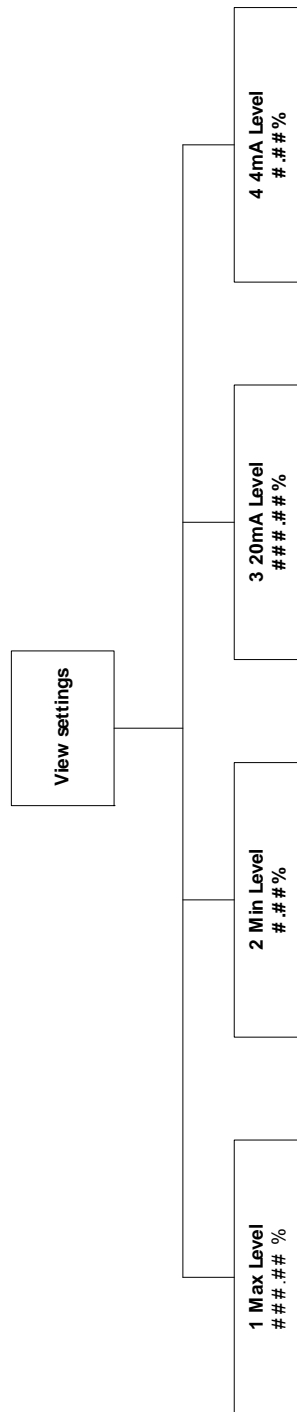


Figure 62: View settings

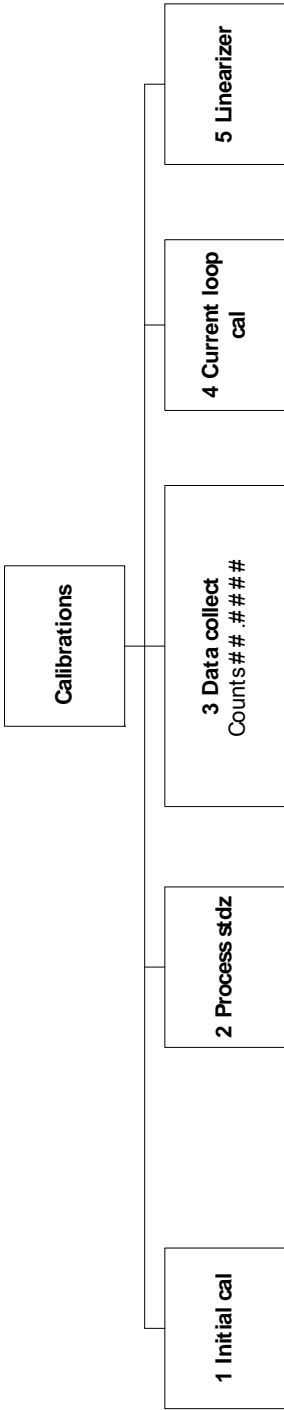


Figure 63: Calibrations

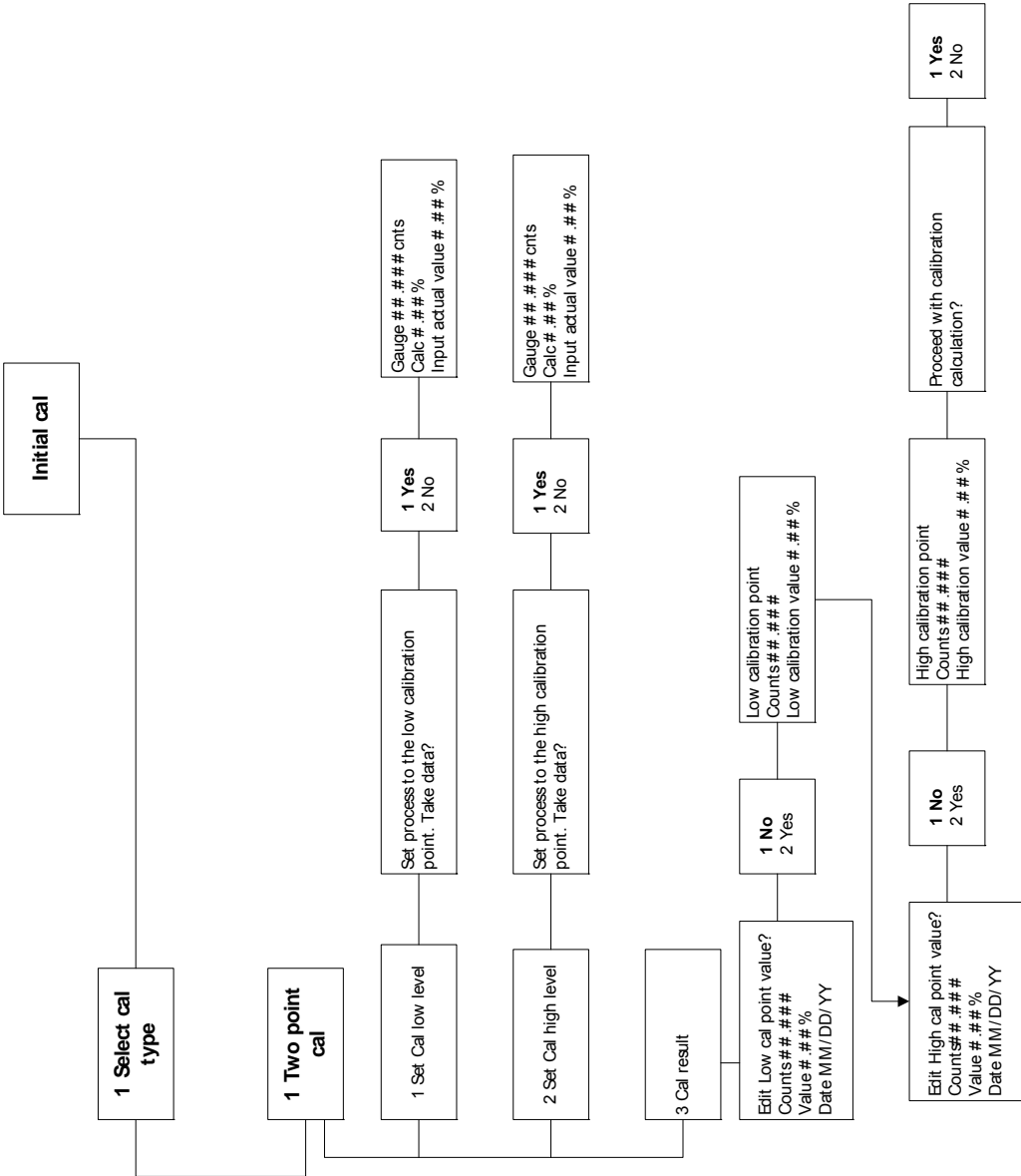


Figure 64: Initial cal

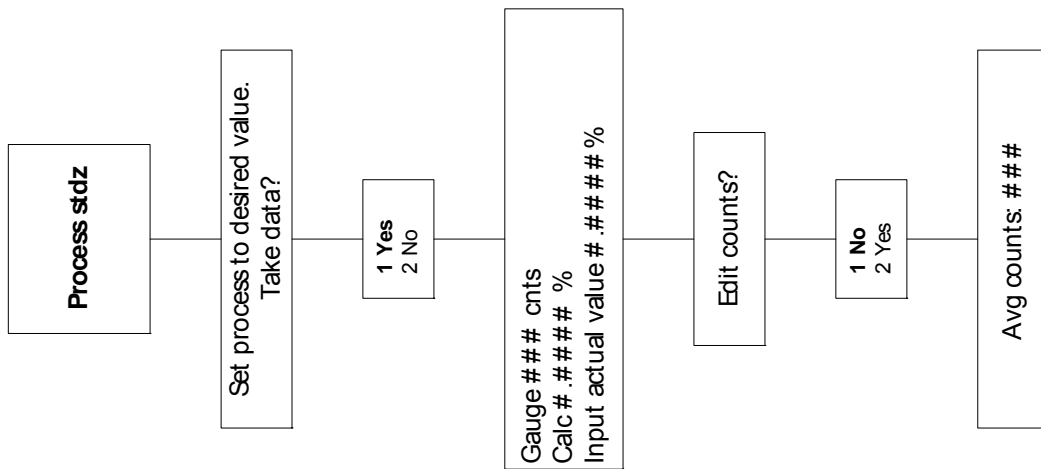


Figure 65: Process stdz

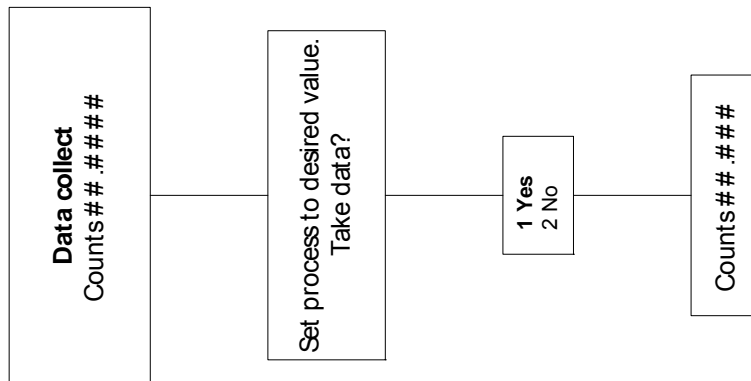


Figure 66: Data collect

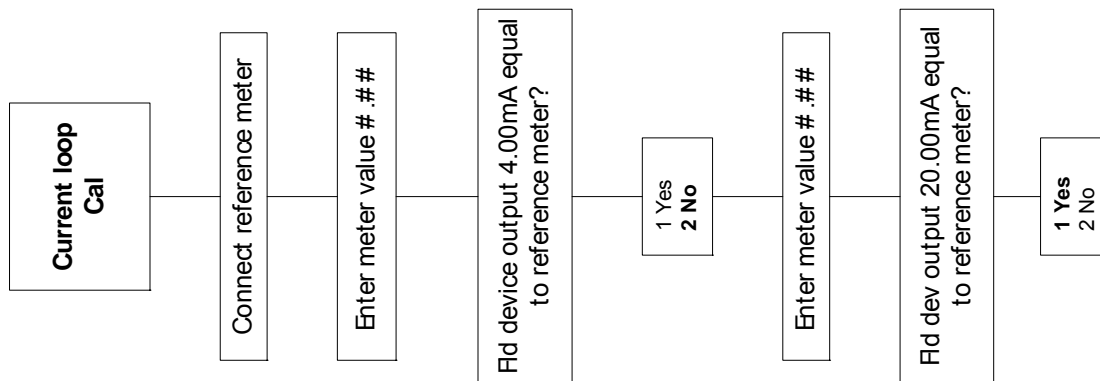


Figure 67: Current loop Cal

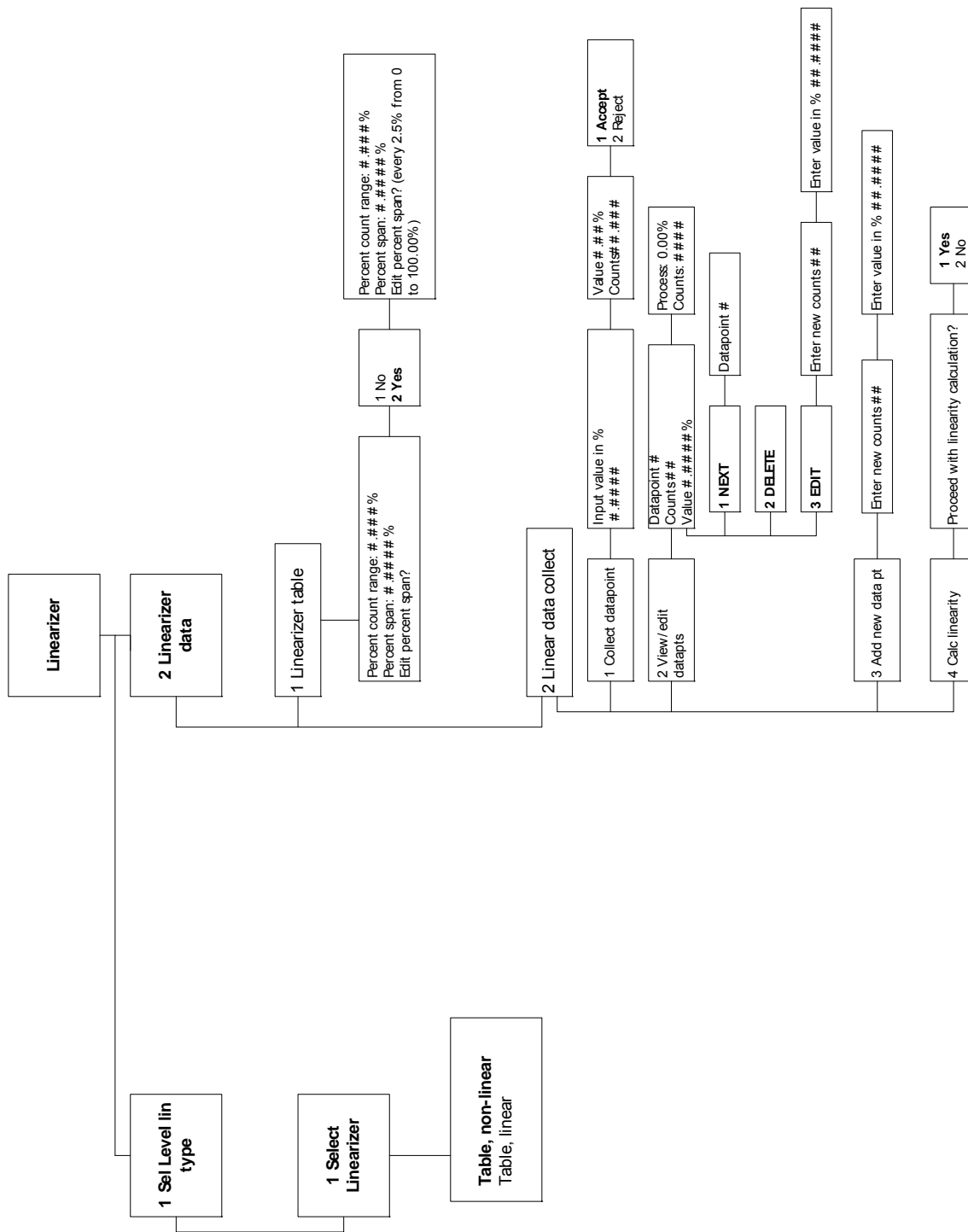


Figure 68: Linearizer

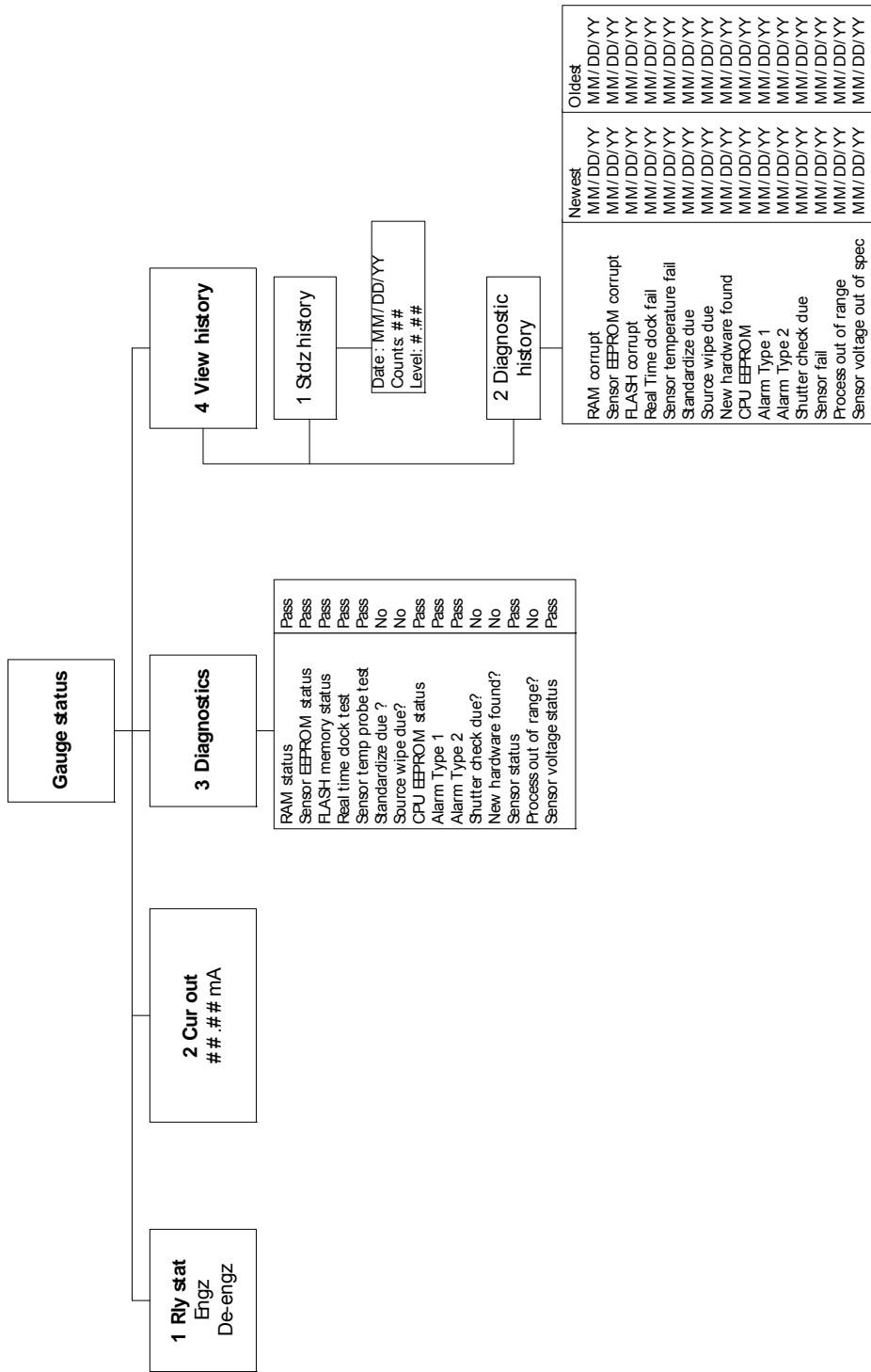


Figure 69: Gauge status

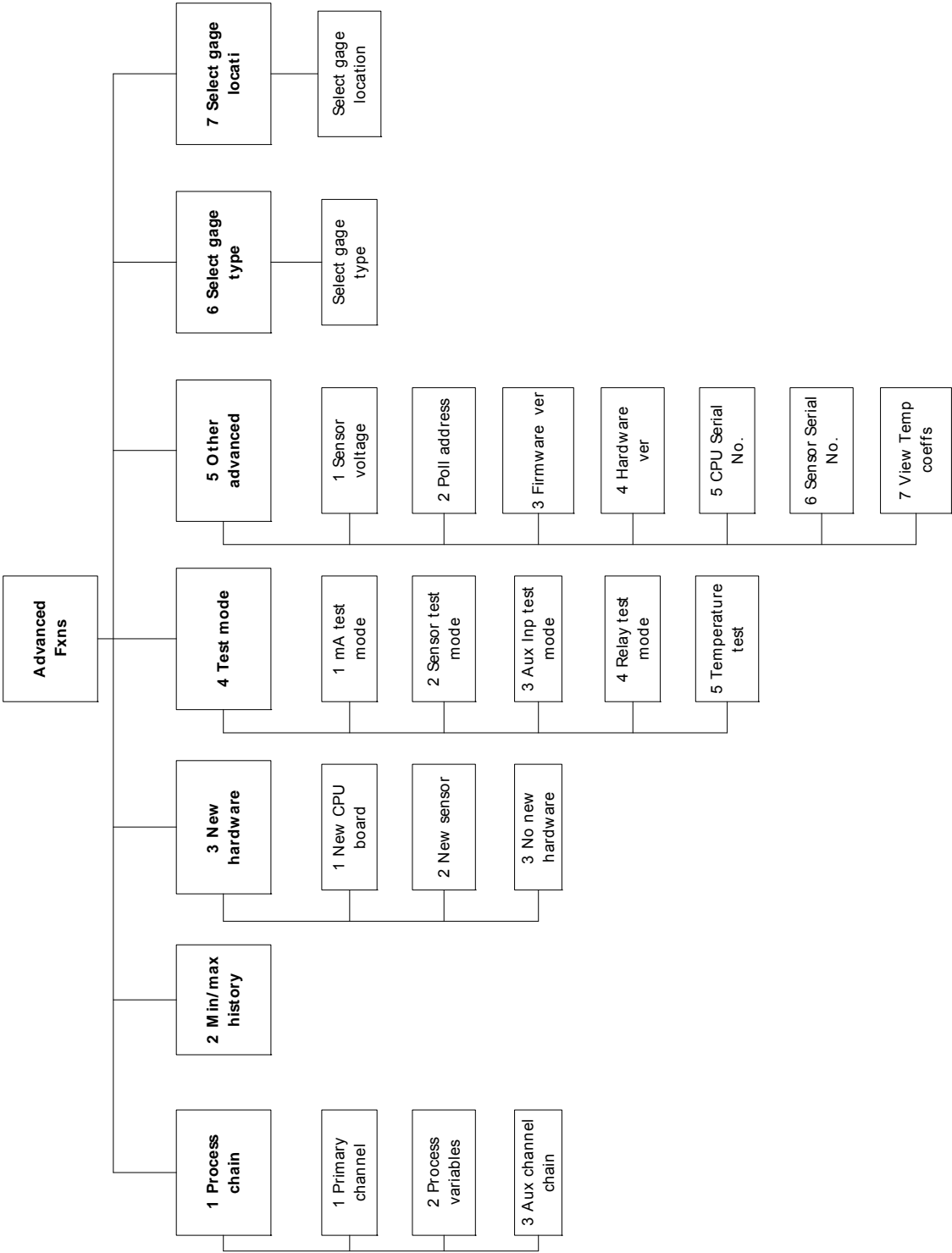


Figure 70: Advanced Fxns

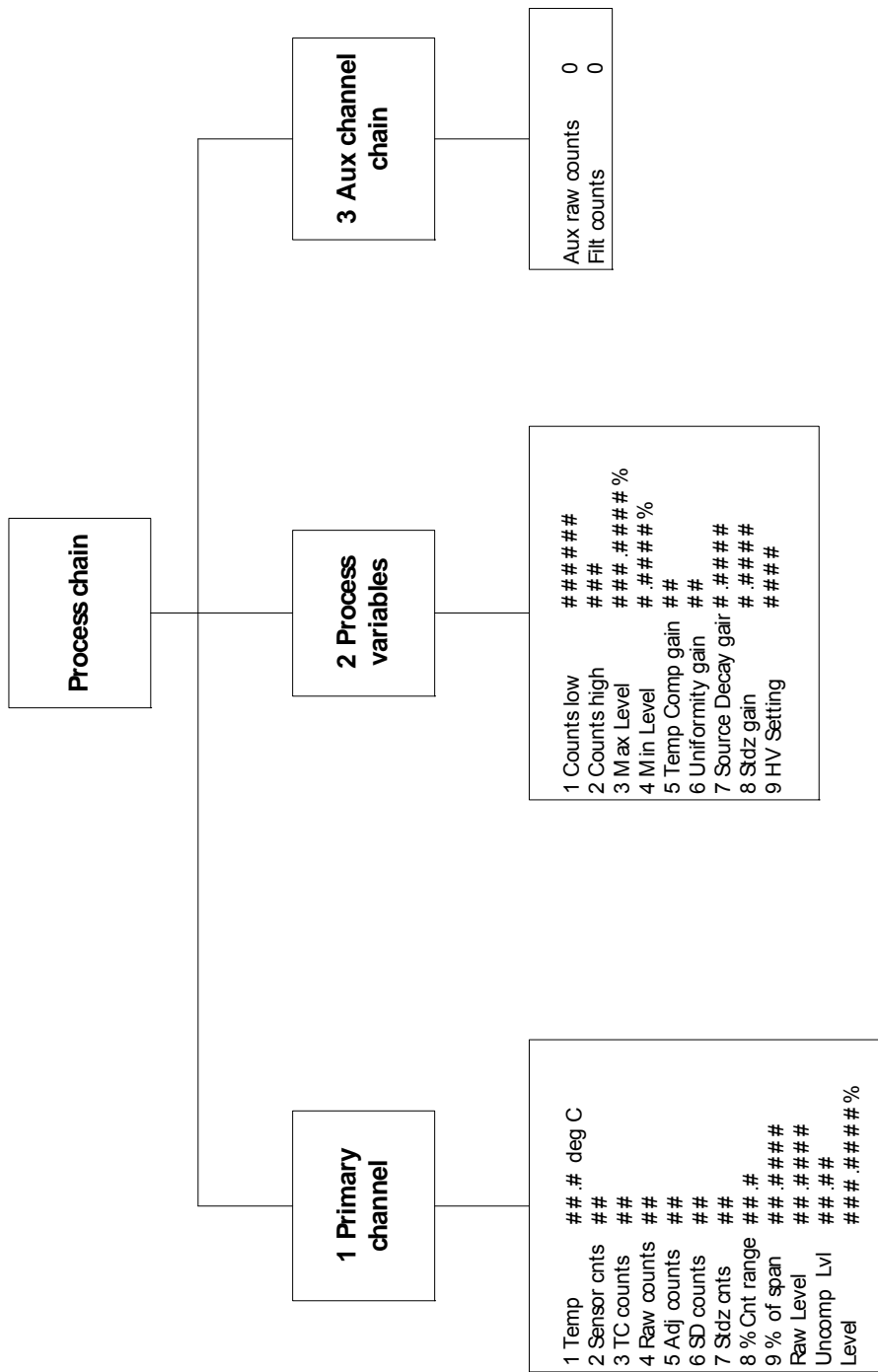


Figure 71: Process chain

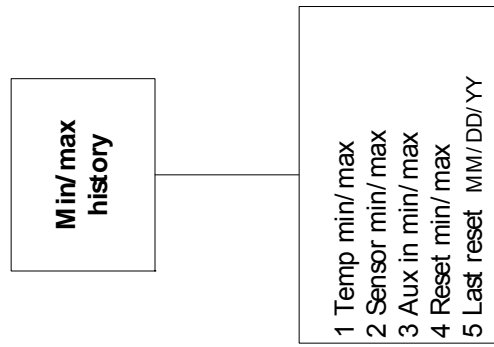


Figure 72: Min/max history

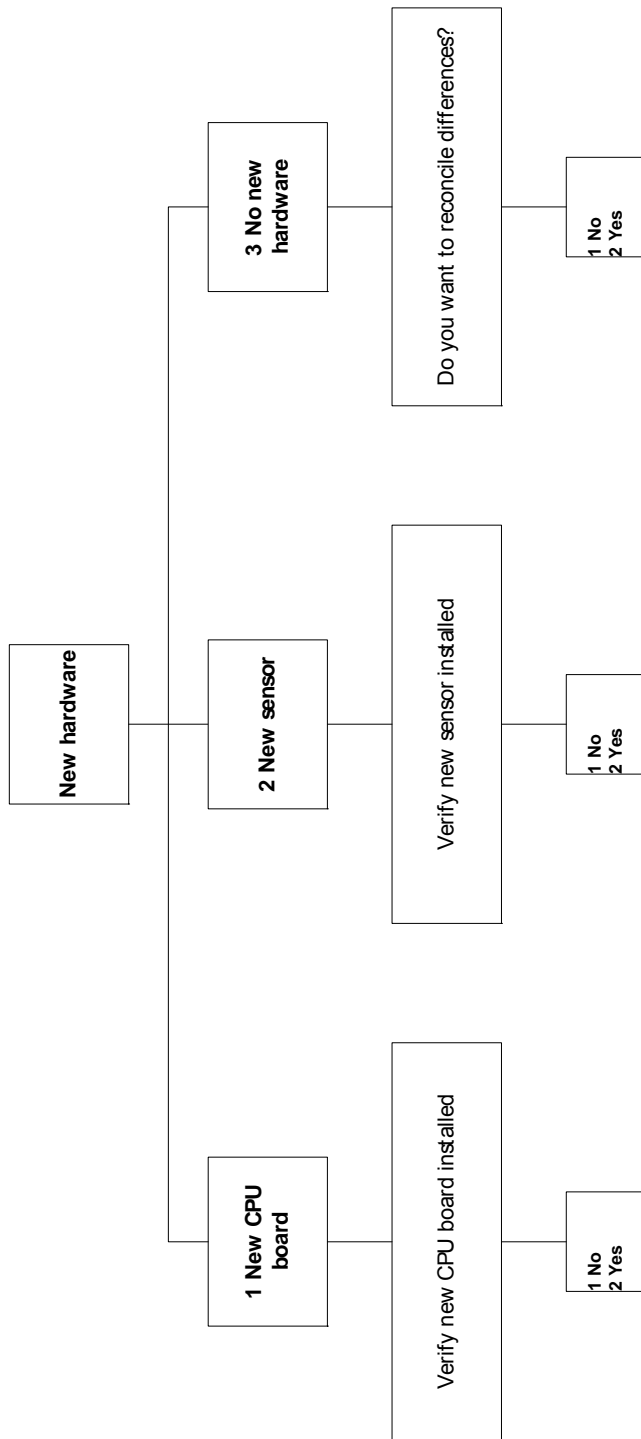


Figure 73: New hardware

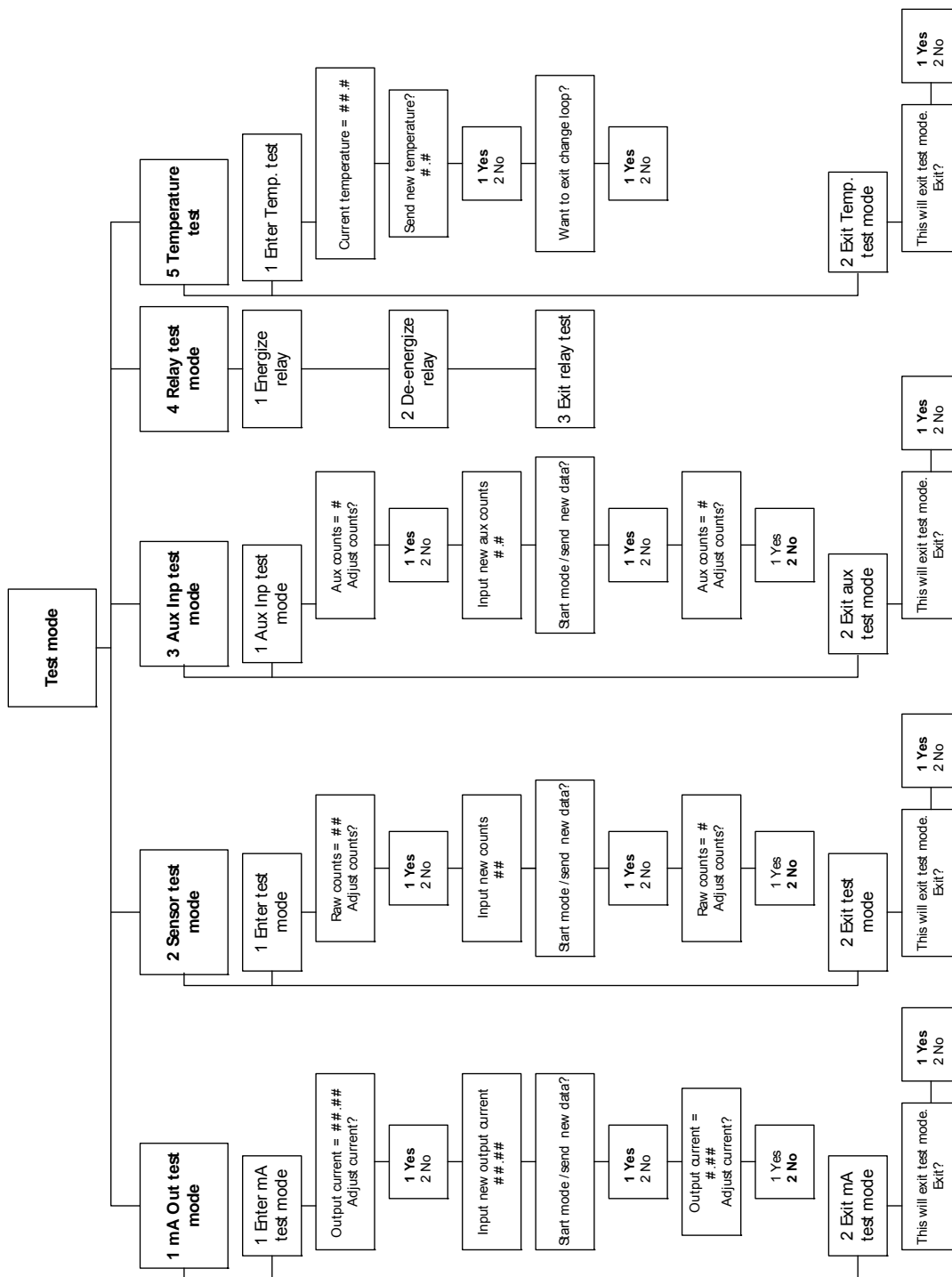


Figure 74: Test mode

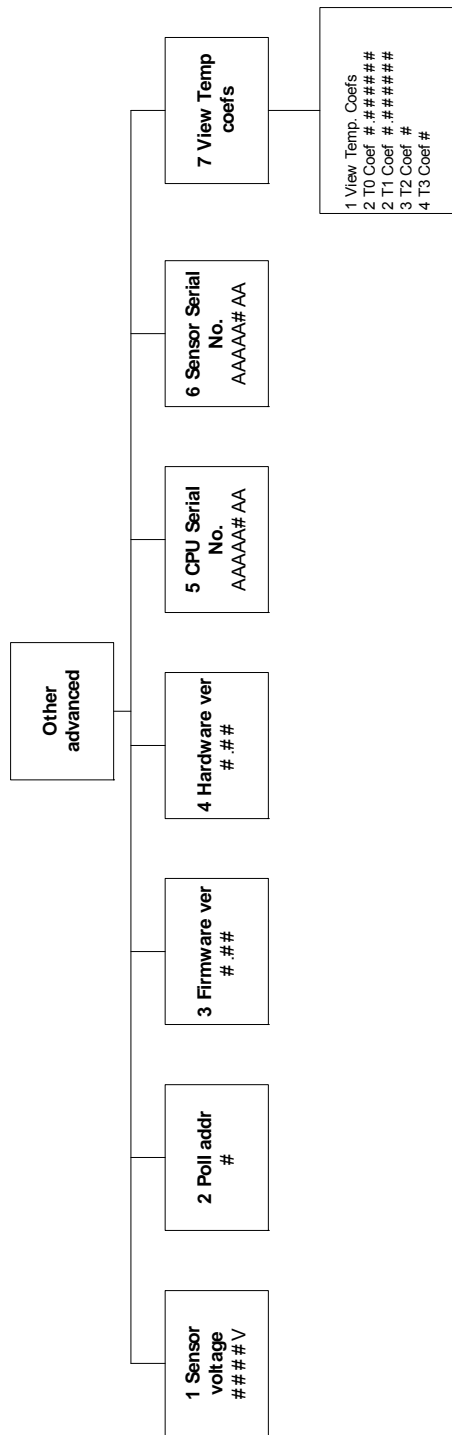


Figure 75: Other advanced

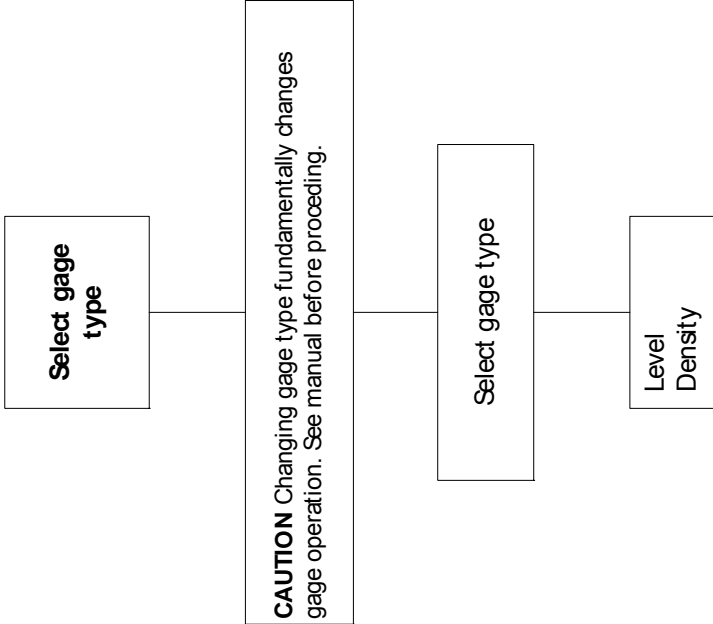


Figure 76: Select gage type

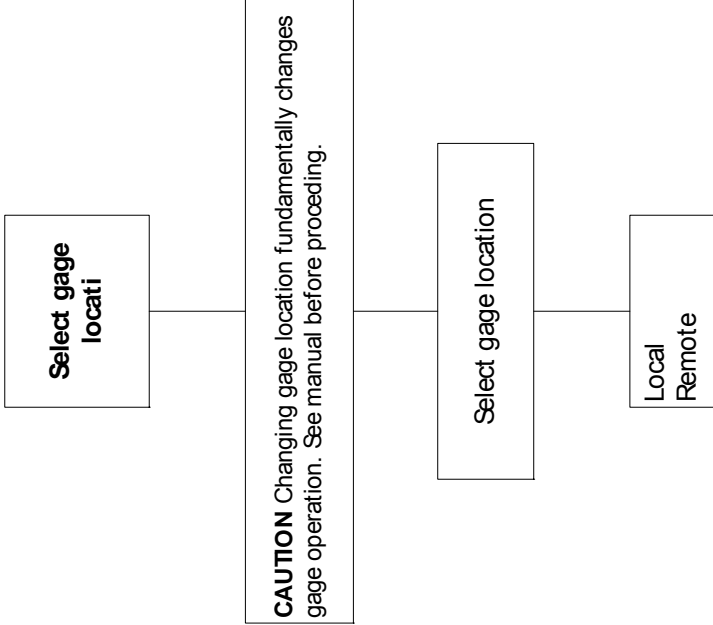


Figure 77: Select gage location

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