

DEP SPECIFICATION

INTELLIGENT FIELD DEVICES – DESIGN AND CONFIGURATION

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for design and configuration of FOUNDATION™ Fieldbus, HART, and Wireless instrumentation.

Excluded from the scope of this DEP are:

- Advanced diagnostic modules for troubleshooting the physical layer of Foundation Fieldbus networks.
- Intelligent field device maintenance.
- Implementation of Wireless field devices including network design.
- Use of HSE linking devices to connect Foundation Fieldbus H1 segments or linking devices to connect multiple wireless clusters for data sharing without the use of a control system.

This is a revision of the DEP of the same number dated February 2017; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorized to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
automation system	A process automation, control and diagnostic system that is composed of distinct modules. These modules may be physically and functionally distributed over the plant area. The automation system contains all the modules and associated software required to accomplish the regulatory control and monitoring of a process plant. This definition of automation system excludes field instruments, remote terminal units, auxiliary systems and management information systems.
basic device	Any physical device not having the capability to control communications on an H1 Fieldbus segment.
Burst mode	A communication relationship where the HART slave device periodically transmits (responds) without individual poll requests from the master
bus	A H1 Fieldbus communications system comprised of the cabling between a host system and the field devices. This system may be comprised of multiple segments, and the length of the home run cable can be extended through the use of repeaters.
capabilities files	Capability files are a set of files that includes Device Descriptions (DD) and the Capability File itself, also known as CFF. The CFF is a virtual description of the device that allows system off-line configuration.
complex control	A control scheme for FOUNDATION™ Fieldbus in which more than three field devices are involved, the use of advanced functionality where blocks are not available in the FF devices, or where advanced control or specific failure behaviours are required
configurable	The capability to select and connect standard hardware modules to create a system; or the capability to change functionality or sizing of software functions by changing parameters without having to modify or regenerate software.
configuration	The physical installation of hardware modules to satisfy system requirements; or the selection of software options to satisfy system requirements.
connector	A coupling device used to connect the wire medium to a Fieldbus device or to another segment of wire.
Control loop	A group of Function Blocks (FBs) that execute at a specified rate within a Fieldbus device or distributed across the Fieldbus network.
Coupler	A physical interface between a trunk and spur, or a trunk and a device
cycle	The scanning of inputs, execution of algorithms and transmission of output values to devices.
deterministic	Ability to measure the maximum delay in delivery of a message between any two nodes in a network. Any network protocol that depends on random delays to resolve mastership is nondeterministic.

Term	Definition
Device Description (DD)	Within Foundation Fieldbus, an extended description of each object in the Virtual Field Device (VFD), and includes information needed for a control system or host system to understand the meaning of data in the VFD. This allows full configuration in both online and offline modes. For HART devices, the DD is an electronic data file that describes specific features and functions of a device including details of menus and graphic display features to be used by host applications (including handheld devices) to access all parameters and data in the corresponding device. This allows limited offline configuration while providing full online configuration functionality.
Device type	In Foundation Fieldbus and HART terms, the device type includes both the device model series and the specific revision for that device model. For example two same model series but with different revisions would result in two different device types.
Device Specific Commands	Device specific commands are unique to the type of HART device. This includes sensor calibration trim, sensor type selection, advanced setup/configuration like radar level transmitter echo curve, and advanced diagnostics such as valve signature, etc.
Dynamic variables	The four principal HART device variables, referred to as PV, SV, TV, and QV
Event notification	HART slave uses burst communication to spontaneously transmit diagnostics status change without a specific request from the master
Fieldbus™	A digital, serial, multidrop, data bus for communication with industrial control and instrumentation devices such as, but not limited to, transducers, actuators and local controllers. This standard only covers the fieldbus physical layer.
HART	Highway Addressable Remote Transducer. A bi-directional 1200 baud digital signal superimposed upon the 4-20 mA signal from field devices. (See http://www.HARTcomm.org)
H1	A term used to describe a FOUNDATION™ Fieldbus network operating at 31.25 Kbit/s.
Home Run Cable	The trunk cable running between the host system H1 interface card and the field junction box housing the device coupler(s). The home run cable may have more than one H1 segment on it.
Host Profile Registration	The HIST become the Host Profile Registration when compatibility testing moved from the Suppliers to the Fieldbus Foundation as part of the inter-operability testing certification.
host system	Control system that has FOUNDATION™ Fieldbus capabilities to configure and operate FOUNDATION™ Fieldbus segments.
I/O input / output subsystem Interface	A device used to connect other types of communications protocols to a Fieldbus segment or segments

Term	Definition
input	Signal from the field device to the host system.
interoperability	Capability of a device from one Manufacturer to interact with that of another Manufacturer on a Fieldbus network without loss of functionality.
interoperability test kit	Kit used by the Foundation to tick mark devices and confirm compliance with the relevant FOUNDATION™ Fieldbus standards. This is a pass/fail test. Only devices passing the full suite of tests receive the FOUNDATION™ Fieldbus "tick mark" (See http://www.fieldbus.org).
Line conditioner	A power supply impedance; used for example with HART partial stroke testers (PST) powered by the same two wires as a solenoid valve.
link	The logical medium by which H1 FOUNDATION™ Fieldbus devices are interconnected. It is composed of one or more physical segments interconnected by bus, Repeaters or Couplers. All of the devices on a link share a common schedule, which is administered by that link's current LAS. It is the data link layer name for a network.
Local master	A HART field device with capability to act as a master to poll the field devices for data.
macrocycle	The repetitious scheduling of the FB within all the devices on a segment. The LAS is responsible for scheduling of the segment macrocycle.
Master	A HART host, wireless adapter, or a smart signal conditioner transmitting request to HART slave. Also includes some field devices such as flowmeters and radar level transmitters which use HART with "local master" capability go get readings from pressure and temperature transmitters
methods	An optional (but highly desirable) addition to Device Descriptions (DDs). Methods are used to define/ automate procedures (such as calibration) for operation of field devices.
mode	Control block operational condition, such as manual, automatic, or cascade.
Multi-drop topology	Multiple HART field transmitters connected in parallel to the same pair of wires in a bus topology only using digital communication, no analogue signal is used.
multiplexer	Host interface with multiple HART communication ports connecting to multiple 4-20 mA loops. This allows additional information (e.g. secondary measurements, diagnostics) from devices by "stripping" off the HART data. This information is then accessible to host software through a secondary network such as over RS-485 or Ethernet using application protocols such as PROFIBUS-DP and HART-IP, etc.
output	Signal generated by the host system and transmitted to a field device

Term	Definition
Point-to-point (topology)	Single HART field device connected in the current loop, using simultaneous digital communication and real-time analogue signal
physical layer	Layer that receives messages from the Communications Stack and converts the messages into physical signals on the Fieldbus transmission medium, and vice-versa.
regulatory control	The functions of process measurement, control algorithm execution, and final control device manipulation that provide closed loop control of a plant process.
Resource Block (RB)	An RB describes characteristics of the Fieldbus device such as the device name, manufacturer and serial number. There is only one RB in a device.
segment	A section of a H1 Fieldbus that is terminated in its characteristic impedance. Segments can be linked by Repeaters to form a longer H1 Fieldbus. Each Segment can include up to 16 physical devices (although the practical or project limit can be lower).
Slave	The field device: transmitter, valve positioner, or analyser, etc. responding to HART requests from the master
spur	An H1 branch line final circuit connecting the field device to the Trunk via the device coupler.
tag	A collection of attributes that specify either a control loop or a process variable, or a measured input, or a calculated value, or some combination of these, and all associated control and output algorithms. Each tag is unique.
terminator	Impedance-matching module used at or near each end of a transmission line that has the same characteristic impedance of the line. Terminators are used to minimize signal distortion, which can cause data errors by converting between current variations and voltage variations. An H1 terminator also has another even more important function. It converts the current signal transmitted by one device to a voltage signal that can be received by all devices on the network.
topology	Shape and design of the Fieldbus network (for example, tree branch, daisy chain, point-to-point, bus with spurs, etc.).
Transducer Block (TB)	Block that decouples FBs from the local input/output (I/O) functions required to read sensors and command output hardware. TBs contain information such as calibration date and sensor type. There is usually one TB channel for each input or output of an FB.
transmitter	An active Fieldbus device containing circuitry, which applies a digital signal on the bus.
triggered burst	HART slave device periodically transmits (response) without individual requests from master, when certain preconfigured trigger condition is met