

Electropneumatic Smart Positioner
A guide to HART® functionality

SP500

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HART 
COMMUNICATION PROTOCOL



2 Introduction

The SP500 smart valve positioner with HART® (Highway Addressable Remote Transducer) interface card connects seamlessly with a standard HART® communication network. It provides a wealth of control and feedback capabilities.

SP500 HART® positioners function as slaves to master controllers on the network. The HART® protocol allows commands, position feedback and diagnostics to be sent digitally over the current loop.

HART® is an open standard supported by the HART® Communication Foundation.

The ability to report extensive positioner feedback data as well as network system diagnostic information makes the SP500 electropneumatic smart valve positioner, the first choice for use with HART® communication systems.

2 HART® option board

The HART® option board is located inside the positioner housing and interfaces directly with the positioner electronics. Once fitted, the specific commands associated with moving the actuator together with feedback and diagnostics become available on the HART® network.

Feedback information includes signals that are not normally available with conventional wiring. For the correct mounting and wiring procedure reference the SP500 Installation and Maintenance Instructions.

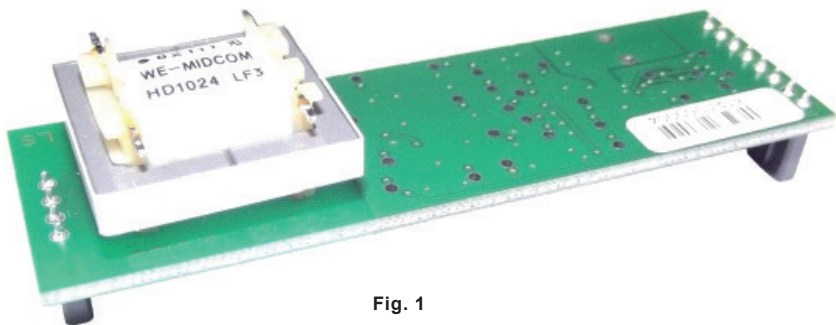


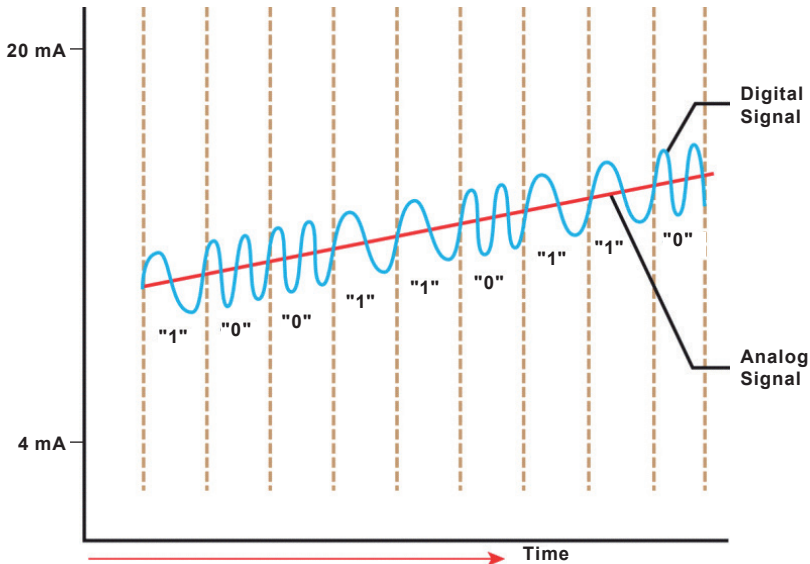
Fig. 1

The HART® network uses the existing wiring of the 4 - 20 mA command current loop. The HART® digital data is coupled onto the analog signal by the use of phase continuous, frequency shift keying (FSK) at a fixed baud rate of 1 200 bits per second.

The command input circuitry filters this super-imposed signal so that analogue positioning (in a point-to-point network) is unaffected.

The protocol utilizes technology based on the Bell 202 standard, enabling cable runs of up to 1.5 km while maintaining high noise immunity. The maximum highway length is dependent on cable type, therefore low capacitance, shielded, twisted pair cable is strongly recommended.

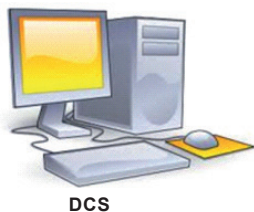
Each instrument is configured to have a unique address on the HART® network. A total of two masters may be used, allowing for example a DCS (primary) and handheld (secondary) communicator tool to be used simultaneously.



FSK Principle (source: HART®)

Fig. 2

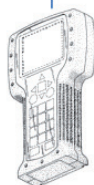
5 Point-to-point network



DCS

In this topology, the control system is directly connected to a single field device - This is the most basic configuration.

The SP500 electropneumatic smart positioner is typically controlled by the 4 - 20 mA loop with the HART® communication providing simultaneous feedback to the DCS such as loop current validation, measured position and status.



Handheld
communication



Fig. 3

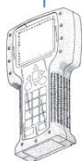
6 Multi drop network



DCS

This topology provides the ability for a DCS to communicate with up to 64 HART® devices on a single network. In this configuration, the loop current is set at a fixed value, (typically 4 mA) and the devices are controlled via HART® commands.

The SP500 HART® smart valve positioner may be positioned by writing a desired setpoint to the device.



Handheld
communication



Fig. 4

DD files have been created specifically for the SP500 HART® smart valve positioner. These files provide access to the complete command set through a user-friendly menu structure, allowing both remote calibration and control of the positioner.

The device description is stored on the host. Once the actuator is identified, the file is automatically loaded and communication with the actuator may commence.

Menu tree and functionalities have been designed to build a similar interface to the one available when access is made locally through the LCD and display.

7.1 Menus structure

Menus contain variables and methods. Methods correspond to positioner actions, like: reset the unit, start the autocalibration function, etc...

Variable can be divided in read only variable that are displayed but cannot be changed, and read & write variables. In general to write a variable it is necessary to change its value and then 'send' it to the instrument.

See the example here below:

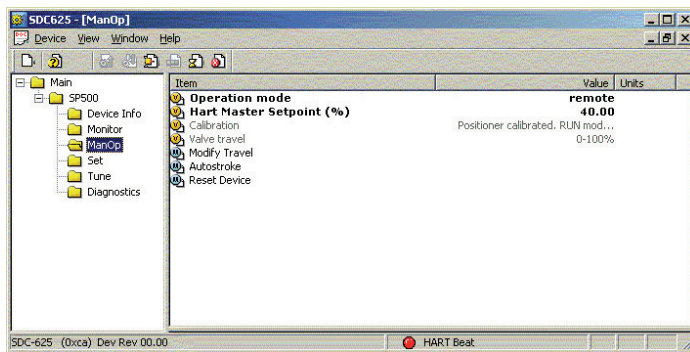


Fig. 5

By double clicking the 'Operation mode' another window will appear allowing you to change the current value.

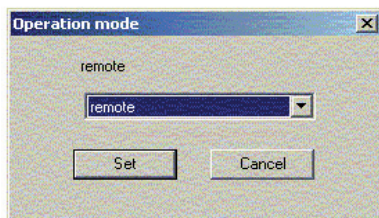


Fig. 6

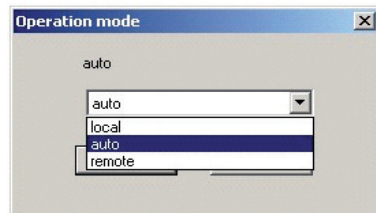


Fig. 7

Choose the desired option and confirm by pressing the 'Set' button. The new value, see below, will appear highlighted in yellow. In order to send the new value to the positioner, press the 'Send' button at the top of the window as shown in the screen shot below.

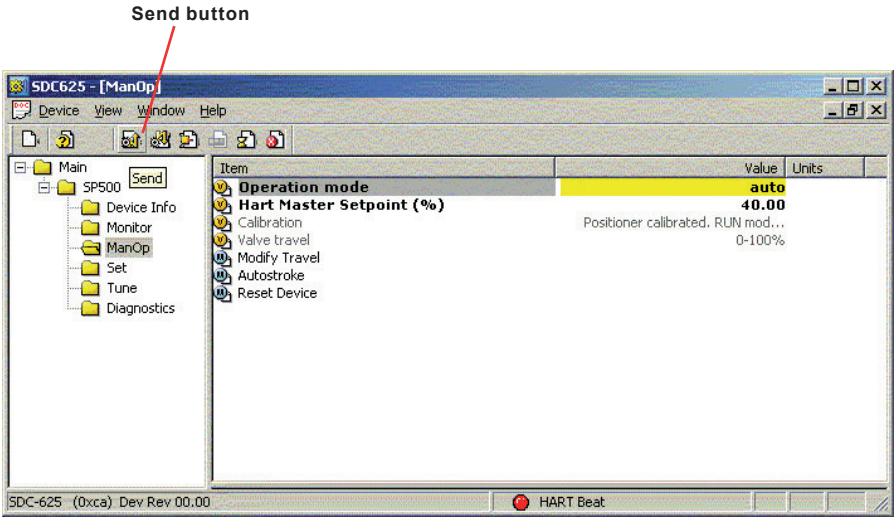


Fig. 8

Remote configuration and control are possible thanks to the software configurator running on the host system. Appearance of the menus and access mode may vary depending on the system used, but functionalities and variables implemented by the DD files will remain the same.

All HART® functionalities and variables are described in the following screen shots and their explanations.

The software configurator used in the screenshots is the SDC625, Smart Device Configurator from the HART® Communication Foundation, which has been used to develop the DD files.

Details about SP500 variables and functions are provided in the SP500 Installation and Maintenance Instructions.

7.2 Menu 'SP500'

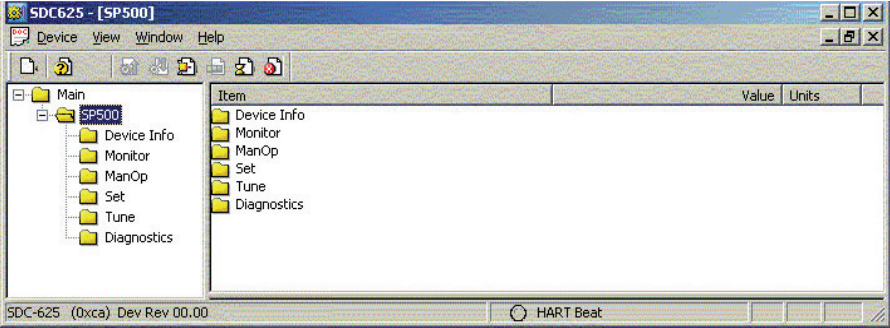


Fig. 9

The SP500 menu gives access to the following menus

Menu	Description
Device Info	General data about the instrument
Monitor	Real time visualization of the main variables values
ManOp	Enables manual control
Set	Setting of valve functions
Tune	Setting of valve tune functions
Diagnostics	Diagnostic functions

As a general rule, variables in bold can be overwritten, while the others are read-only variables.

7.3 Menu 'Device Info'

General data from the instrument:

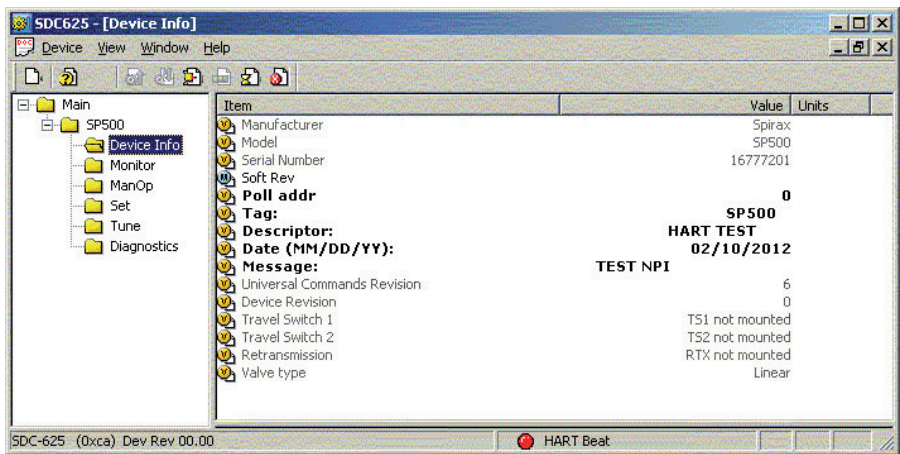


Fig. 10

Variable	Description	
Manufacturer	Manufacturer name	
Model	Instrument model	
Serial number	Positioner serial number	
Soft rev	Positioner software revision	
Poll addr	HART® address (default is 0)	
Tag	Instrument tag	
Description	Brief description, for example, 'steam control valve'	
Date (MM/DD/YY)	Any significant date can be stored here e.g. maintenance	
Message	Any message or comment	
Universal commands revision	HART® protocol revision data	
Device revision	Hardware version	
Travel switch 1	Travel switch 1 status:	
	NOT MOUNTED	option board not mounted
	DISABLED	TS1 disabled
	ON	TS1 on
	OFF	TS1 off
Travel switch 2	Travel switch 2 status:	
	NOT MOUNTED	option board not mounted
	DISABLED	TS2 disabled
	ON	TS1 on
	OFF	TS2 off
Retransmission	Retransmission status:	
	AVAILABLE	RTX board mounted
	NOT MOUNTED	RTX board no mounted
Valve type	Indicate the positioner valve type	
	LINEAR	SP500 rotary positioner
	ROTARY	SP500 linear positioner

7.4 Menu 'Monitor'

Real time visualization of the main variables and values:

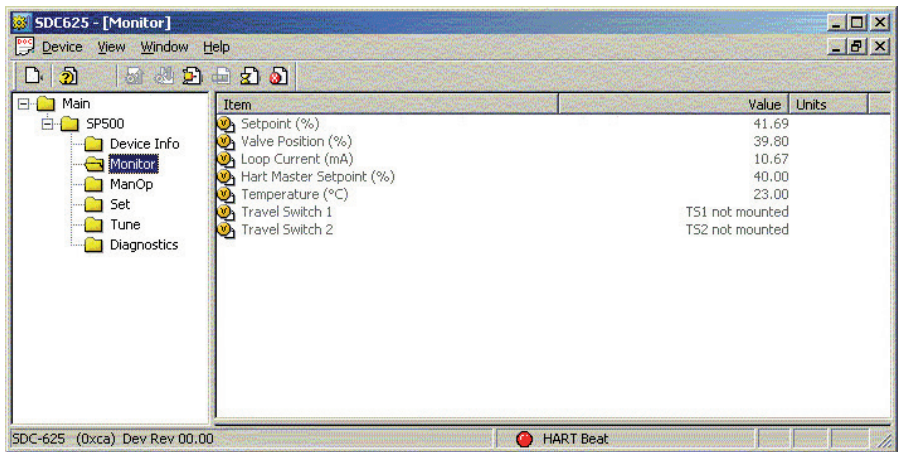


Fig. 11

Variable	Description
Setpoint (%)	Current setpoint in %
Valve position (%)	Actual valve position in %
Loop current (mA)	Actual input current in mA
HART master setpoint (%)	Setpoint value sent from HART master
Temperature (°C)	Temperature sensed inside the positioner housing
Travel switch 1	TS1 current status
Travel switch 2	TS2 current status

7.5 Menu 'ManOp'

This enables manual control and remote HART® master control:

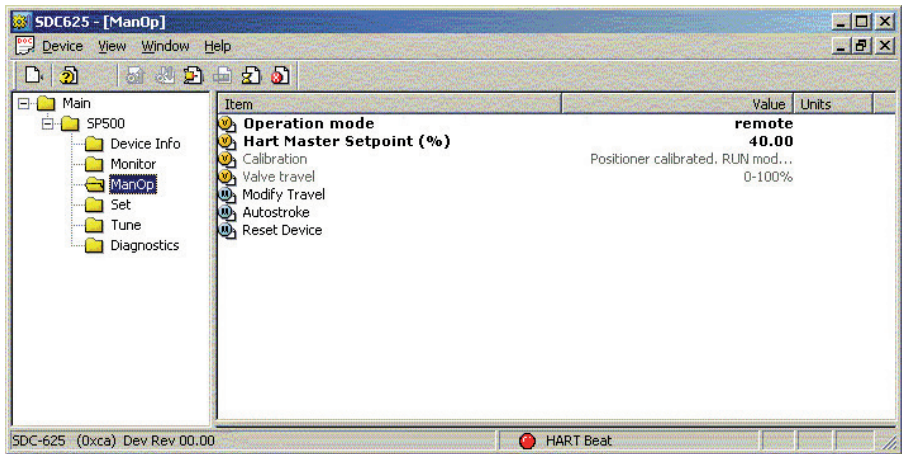


Fig. 12

Variable	Description	
Operation mode	Status of the operation mode:	
	REMOTE	The positioner will use 'HART® master setpoint' as valve setpoint regardless of the value of the current in the loop
	LOCAL	This option is not selectable and cannot be changed remotely. It indicates the positioner is driven using a local keyboard through the MCTL local menu
	AUTO	The positioner is working in automatic mode and the loop current is used as the actual valve setpoint
	Selectable values are AUTO and REMOTE	
HART® master setpoint	Selectable value in %; allowed values are between 0-100%. It becomes the actual setpoint when the 'Operation mode' is set to REMOTE.	
Calibration	Positioner status:	
	SP500 CALIBRATED	Autostroke executed successfully
	SP500 NOT CALIBRATED	Autostroke to be run
Valve travel	Shows the valve travel display settings (0-100% or 100-0%)	
Modify travel	This is a method that modifies the 'Valve travel' (0 to 100% or 100-0%)	
Autostroke	Start the autostroke routine	
Reset device	Reset all values to initial factory setting. After reset, 'Autostroke' needs to be rerun.	

7.6 Menu 'Set'

Setting the valve functions:

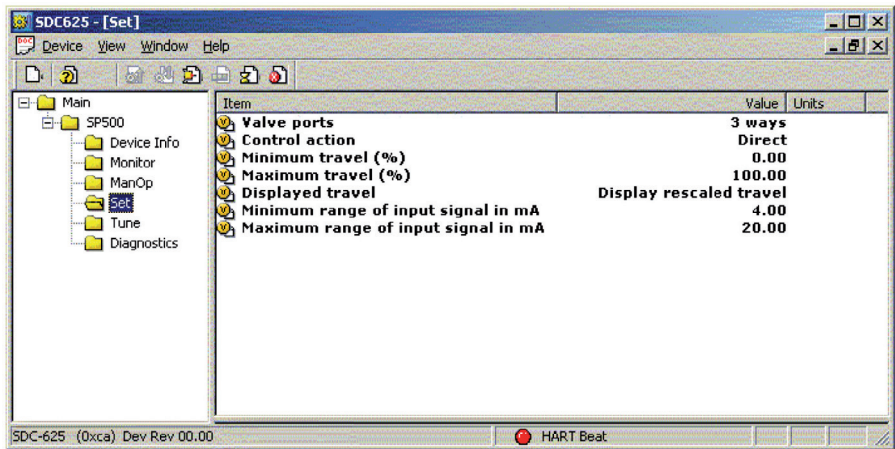


Fig. 13

Variable	Description
Valve port	Valve type (2 or 3 way)
Control action	Control action (direct or inverse)
Minimum travel (%)	Minimum travel settings
Maximum travel (%)	Maximum travel settings
Displayed travel	Sets the displayed travel percentage option
Minimum range mA	Minimum signal span range in mA
Maximum range mA	Maximum signal span range in mA

7.7 Menu 'Tune'

Setting the valve tune functions:

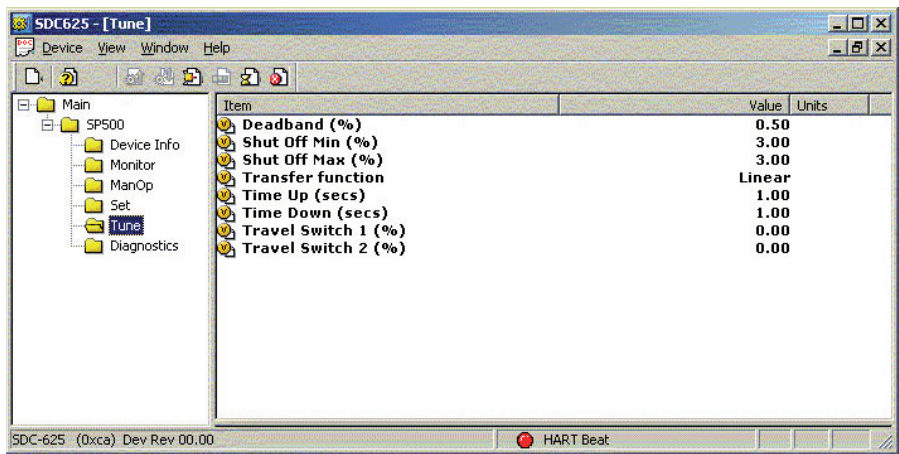


Fig. 14

Variable	Description
Deadband (%)	Deadband (%)
Shut off min (%)	Valve shut off minimum travel
Shut off max (%)	Valve shut off maximum travel
Transfer function	Valve characterisation (LINEAR, EQUAL, FAST)
Time up (sec)	Sets the displayed travel percentage option
Time down (sec)	Slow down valve closing action
Travel switch 1 (%)	Threshold value for TS1
Travel switch 2 (%)	Threshold value for TS2

7.8 Menu 'Diagnostics'

Diagnostic functions:

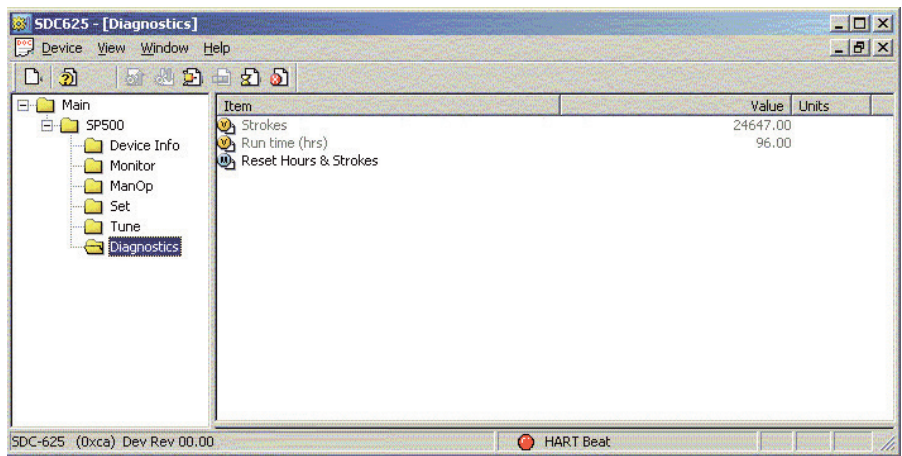


Fig. 15

Variable	Description
Strokes	Number of strokes during operation
Run time	Operation time
Reset hours and strokes	Reset 'Strokes' and 'Run time'



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