Technical Bulletin, Communicating with Honeywell™ SMV3000 Multivariable Transmitters

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NOTE: User Manual Reference - This Technical Bulletin complements the information contained in the User Manual, and is applicable to all firmware revisions .74+.

Communication with Honeywell™ SMN3000 Smart Transmitters – This feature allows you to communicate with Honeywell SMV3000 Smart Multivariable Transmitters which provide Differential Pressure, Temperature and Static Pressure, via OMNI's HV type Process I/O Combo Modules and using Honeywell's DE Protocol.

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Scope

All OMNI 6000/OMNI 3000 Flow Computers containing firmware 21.74+, 23.74+, 27.74+ are able to communicate with Honeywell™ SMV3000 Smart Multivariable Transmitters. This feature uses Honeywell's DE Protocol and requires that an HV Combo I/O Module be installed in your flow computer.

Abstract

Using an 'HV' Combo I/O Module, the OMNI Flow Computer can communicate with up to four (4) Honeywell™ SMV3000 Smart Multivariable transmitters. These transmitters provide Differential Pressure, Temperature and Pressure signals using Honeywell's DE Protocol. Only one (1) 'HV' Type Combo Module can be installed in the flow computer. Loop power is provided by the 'HV' combo module.

DE Protocol Overview

Digital data is transmitted serially between the flow computer and Honeywell Smart Transmitters by modulating the current in the two wire loop connecting the devices. Power for the transmitter is also taken from this current loop. Data is transmitted at 218.47 bits per second with a digital '0' = 20 mA and a digital '1' = 4 mA.

In normal operation, the Honeywell transmitter operates in the '6-byte Burst Mode'. In this mode, the transmitter transmits the following data to the flow computer every 366 msec:

Byte #1	Status Flags
Byte #2-#4	Process Variables % Span Value (3-byte floating point)
Byte #5	Database ID (indicates where in the transmitter database Byte #6 belongs)
Byte #6	Database Data Value

Transmitter Database

By using the data contained in Bytes #5 and #6, the flow computer builds and maintains an exact copy of the multivariable transmitter's configuration database. The transmitter database, which is sent to the OMNI Flow Computer, is about 132 bytes. Based on the burst rate of the transmitter it can take about forty-five (45) to fifty-five (55) seconds to completely build a copy of the transmitter database within the flow computer. The transmitter database is continuously compared against the flow computer configuration settings for that transmitter. The flow computer automatically corrects any differences between the databases by writing the correct configuration data to the transmitter.

The Honeywell™ Handheld Communicator

The flow computer is responsible for configuring the following entries within the transmitter:

- Lower Range Value or Zero
- Transmitter Span or Max Range
- Damping Factor
- Tag Name
- DP, SP and Temperature conformance bits

Any changes made to 1, 2, 3 and 5 using the handheld communicator will be overwritten by the flow computer. In the digital mode it is not absolutely necessary to calibrate the transmitter's outputs using the handheld communicator. The user can however trim the transmitter's output calibration using the handheld communicator if he so desires, without interference from the flow computer (refer to Honeywell documentation for details of trimming corrects). Whether the transmitter is trimmed with the handheld or not, the digital signals should be final calibrated 'end to end' using the normal analog input method described in Chapter 8 of Volume 1 of the User Manual.

Combo Module LED Status Indicators

Each I/O channel of the 'HV' Combo module has a set of two (2) LED indicators, one (1) green and one (1) red. The green LED shows all communication activity taking place on the channel (flow computer, transmitter and handheld communicator if connected). The Red LED lights only when the flow computer is transmitting data to the transmitter. Normal digital operation is indicated by a regular pulsation of the green LED (about three (3) pulses per second). The red LED will be seen to blink whenever a configuration change is made in the flow computer which affects that particular transmitter.

Switching Between Analog and Digital Mode

Connecting an analog mode Honeywell multivariable transmitter to the flow computer will cause it to automatically switch the transmitter to the digital DE mode sending out a series of "Wake up" commands to the Honeywell transmitter. A switch over to the digital mode by the transmitter will cause the green LED on the combo module to pulse steadily indicating that communications have been established. To disable the wake up command and initialize communications between the Honeywell transmitter and the flow computer, delete all I/O point assignments within the flow computer to that I/O point. Using the Honeywell handheld communicator press **[Shift] [A/D]** and wait until the handheld displays 'Change to Analog?' Answer by pressing **[Enter]** (Yes). 'SFC Working' will be displayed. The green LED on the 'HV' Combo module on that channel will stop pulsing. Reentering the I/O point will cause the OMNI to send the wake up command to the Honeywell and after three (3) commands sends the green LED on the Honeywell module will pulse at a steady 3Hz rate.

Viewing the Status of the Honeywell Transmitter from the Keypad

To verify the data being received from the smart transmitter, press **[Input] [Status]** and **[Enter]** from the front panel. The following data displays:

```
HV-1 Transmitter
DB Status          OK
Gstatus NON-CRITICAL
DP%             25.00
SP%             76.50
TT%             32.13
DP LRV            0.0
DP Span         400.0
DP Damp Secs.     .16
DP Conformity bit  0
SP LRV          406.8
SP Span       27680.2
SP Damp Secs      .16
SP Conformity bit  0
TT LRV             .0
TT Span         100.0
TT Damp Secs       .3
TT Conformity bit  0
SW Revision       2.1
Serial #  xxxxxxxxxx
DP Range        400.0
SP Range      20760.5
TT Range        850.0
ID/TAG       SMV-3000
Filter Hertz       60
SensorType RTD-PT100
```

Viewing the Status of the Honeywell™ Transmitter from the Keypad

HV-1 Transmitter : Indicates the Honeywell Multivariable Combo Module (HV) and the channel number on that module. As there can be only one (1) HV module installed, this number can only be one (1) through four (4).

DB Status : There are five (5) status states.

- 1) OK: Communications between the flow computer and smart Honeywell transmitter are OK. The database within the transmitter matches the flow computer.
- 2) Idle: This flow computer I/O point has been assigned to a Honeywell transmitter but is not receiving data from the transmitter. Possible cause is a wiring problem such as reversal of wiring. If you observe the status LEDs you will note that the flow computer attempts to establish communications by sending a wake-up command approximately every ten (10) seconds.
- 3) Bad PV: Communications between the flow computer and smart Honeywell transmitter are OK but the transmitter has determined that a critical error has occurred within the transmitter, meaning the value of the process variable cannot be trusted. The flow computer will set the transducer failure alarm and follow the fail code strategy selected by the user for this transducer.
- 4) DB Error: Communications between the flow computer and smart Honeywell transmitter are OK but the flow computer has determined that the database within the flow computer does not agree with the database within the transmitter. If you observe the status LEDs you will note that the flow computer attempts to correct the transmitter's database by writing the correct data to the transmitter once every 30-45 sec.
- 5) 4 Byte: The transmitter is operating in the 4-Byte Burst Mode. Because the flow computer will not tolerate this mode of operation, this status display should only be displayed momentarily as the flow computer will automatically switch the transmitter into the 6-Byte Burst Mode.

Gstatus: Gross Status Flag value:

- 1) OK: No errors are reported by the SMV transmitter.
- 2) Critical: Critical error reported by the SMV transmitter.
- 3) Non-Critical: An error of a non critical nature has been reported by the SMV transmitter.
- 4) Reserved: Consult Honeywell if this status value is returned.

DP%: Differential pressure variable value in percentage of the transmitter span. A -25.00 could mean that the transmitter is not communicating (refer to Status definition previous).

SP%: Static pressure variable value in percentage of the transmitter span. A -25.00 could mean that the transmitter is not communicating (refer to Status definition previous).

TT%: Temperature variable value in percentage of the transmitter span. A -25.00 could mean that the transmitter is not communicating (refer to Status definition previous).

DP LRV: Lower Range Value of the DP variable in engineering units. Engineering units are inches of water at 39°F.

DP Span:	The Span of the Differential pressure variable in engineering units (the span is the difference between the lower and upper ranges of the transmitter). Engineering units are inches of water at 39°F. The flow computer will display 'DB Error' if the user tries to enter a span of 0% or a span which would exceed the DP sensor 'range' (described later).
DP Damp Secs:	Damping Time of the DP transmitter output in seconds.
DP Conformity Bit:	Meaningful only with differential pressure transmitters. Conformity Bit 0 = linear output; Conformity Bit 1 = square root output. The flow computer requires linear output and will automatically set this bit to zero (0) should it be set to a one (1).
SP LRV:	Lower Range Value of the Static Pressure variable in engineering units. Engineering units are inches of water at 39°F.
SP Span:	The Span of the Static Pressure variable in engineering units (the span is the difference between the lower and upper ranges of the transmitter). Engineering units are inches of water at 39°F. The flow computer will display 'DB Error' if the user tries to enter a span of 0% or a span which would exceed the static pressure sensor 'range' (described later).
SP Damp Secs:	Damping Time of the Static Pressure transmitter output in seconds.
SP Conformity Bit:	Meaningful only with differential pressure transmitters.
TT LRV:	Lower Range Value of the temperature variable in engineering units. Engineering units are degrees Celsius.
TT Span:	The Span of the Temperature variable in engineering units (the span is the difference between the lower and upper ranges of the transmitter). Engineering units are degrees Celsius. The flow computer will display 'DB Error' if the user tries to enter a span of 0% or a span which would exceed the temperature sensor 'range' (described later).
TT Damp Secs:	Damping Time of the Temperature transmitter output in seconds.
TT Conformity Bit:	Meaningful only with differential pressure transmitters.
Software Revision:	Current Software installed within the smart multivariable device.
Serial #:	Serial Number of the smart multivariable device.
DP Range:	Maximum range of the DP sensor in inches of water at 39°F. The transmitter will not accept configuration entries which exceed this value.
SP Range:	Maximum range of the Static Pressure sensor in inches of water at 39°F. The transmitter will not accept configuration entries which exceed this value.
TT Range:	Maximum range of the Temperature sensor in degrees Celsius. The transmitter will not accept configuration entries which exceed this value.
ID/TAG:	ASCII string used to identify the SMV DP transmitter.
Filter Hertz:	Frequency used to filter sensor signals to minimize AC mains interference. Selections are 50 or 60 Hertz.
Sensor Type:	Temperature sensor types are: • RTD-PT100 • J type Thermocouple • K type Thermocouple • T type Thermocouple • E type Thermocouple **NOTE:** Thermocouples can be internally or externally compensated.

Obtaining More Detailed Status Information from the Keypad

Additional data based upon the 'Primary', 'Secondary' and 'Tertiary' 'Detailed Status' bytes which are retrieved from the SMV data base is available by pressing **[Input] [Status] [Alarm]** and **[Enter]**. The display will approximate the messages shown in Table 1 depending upon certain bits being ON in the appropriate 'detailed status byte'. Some of these status bits also cause alarm status points within the flow computer database to be activated. When this happens, these alarm events are time and date tagged and logged in the alarm log as any other flow computer alarm.

Table 1. Detailed Status Information

HONEYWELL DETAILED STATUS BYTE-BIT	TEXT IN 'BOLD' DISPLAYED	OMNI ALARM POINT(S) ACTIVATED
1-0	**Meter Body Fault**: Communication between sensor board and SMV main board electronics is suspect	2n44 CR 2n47 CR 2n50 CR
1-1	Characterization **PROM Fault** or Checksum Error	2n44 CR 2n47 CR
1-2	**Suspect Input**: Possibly Meter Body or Electronics Failure	2n44 CR 2n47 CR
1-3	**DAC Compensation**: Fault Detected	2n52 CR
1-4	**NVM Fault**: Non Volatile Memory Error Detected	2n52 CR
1-5	**RAM Fault**: RAM Memory Error Detected	2n52 CR
1-6	**ROM Fault**: ROM Memory Error Detected	2n52 CR
1-7	**PAC Fault** Detected	2n44 CR 2n47 CR
2-0	**MB OverTemp**: Meter Body Sensor Over Temperature	2n51 NC
2-1	**DP Zero Correction** Value is Outside of Acceptable Limits	2n42 NC
2-2	**DP Span Correction** Value is Outside of Acceptable Limits	2n42 NC
2-3	**Status 2-3** (Consult with Honeywell for meaning)	----
2-4	MB Overload or: (Always with next message)	2n47 CR
2-5	**Meter Body Fault**: Pressure input is twice the URL	2n47 CR
2-6	**DP Cal Corr Default**: 'Reset Corrects' command issued or 'Calibrate and Power Cycle' performed	2n42 NC
2-7	**DAC Tempco Data Bad**: Analog mode only	----
3-0	**Invalid Database**: Some error detected in the SMVs configuration. All PVs are suspect	2n44 CR 2n47 CR 2n50 CR
3-1	**Suspect SP Input**: Static pressure input suspect	2n47 CR
3-2	**Status 3-2** (Consult with Honeywell for meaning)	----
3-3	**Status 3-3** (Consult with Honeywell for meaning)	----
3-4	**DP Term Out of Range**	----
3-5	**V-T Term Out of Rng**: Viscosity temperature term out of range	----

HONEYWELL DETAILED STATUS BYTE-BIT	TEXT IN 'BOLD' DISPLAYED	OMNI ALARM POINT(S) ACTIVATED
3-6	**D-T Term Out of Rng**: Density temperature term out of range	----
3-7	**Ind Var Out of Range**: Independent variable out of range	----
4-0	Status 4-0 (Consult with Honeywell for meaning)	----
4-1	**Excess Zero Corr SP**: Excess zero correction for static pressure	2n45 NC
4-2	**Excess Span Corr SP:** Excess span correction for static pressure4-3	2n45 NC
4-3	**SP is Absolute: Static pressure sensor is absolute**	----
4-4	**SP is Gauge:** Static pressure sensor is gauge	----
4-5	**Status 4-5** (Consult with Honeywell for meaning)	----
4-6	**SP Corrects Reset:** Static pressure corrections reset	2n45 NC
4-7	**Status 4-7** (Consult with Honeywell for meaning)	----
5-0	**Status 5-0** (Consult with Honeywell for meaning)	----
5-1	**Status 5-1** (Consult with Honeywell for meaning**)**	----
5-2	**Status 5-2** (Consult with Honeywell for meaning)	----
5-3	**Status 5-3** (Consult with Honeywell for meaning**)**	----
5-4	**DP in Input Mode**	2n43 CR
5-5	**SP in Input Mode**	2n46 CR
5-6	**Temp in Input Mode**	2n49 CR
5-7	**PV4 in Input Mode**	----
6-0	**2 Wire RTD Used**	----
6-1	**3 Wire RTD Used**	----
6-2	**4 Wire RTD Used**	----
6-3	**2 Wire TC Used**	----
6-4	**DP in Output Mode**	2n43 CR
6-5	**SP in Output Mode**	2n46 CR
6-6	**Temp in Output Mode**	2n49 CR
6-7	**PV4 in Output Mode**	----
7-0	**Temp A/D Fault:** Temperature A to D failure	2n50 CR
7-1	**Temp Char Fault:** Temperature characterization fault	2n50 CR
7-2	**Temp Input Suspect:** Temperature input signal is suspect	2n50 CR
7-3	**Status 7-3** (Consult with Honeywell for meaning)	----
7-4	**Temp NVM Fault: Temperature non-volatile memory fault detected**	2n50 CR
7-5	**Status 7-5** (Consult with Honeywell for meaning)	----

HONEYWELL DETAILED STATUS BYTE-BIT	TEXT IN 'BOLD' DISPLAYED	OMNI ALARM POINT(S) ACTIVATED
7-6	**Status 7-6** (Consult with Honeywell for meaning**)**	----
7-7	**Status 7-7 (Consult with Honeywell for meaning)**	----
8-0	**Delta Temperature: (FUTURE – Consult with Honeywell for meaning)**	----
8-1	**Excess Zero Cor Temp**	2n48 NC
8-2	**Excess Span Cor Temp**	2n48 NC
8-3	**Temp Input Open:** Open circuit temperature sensor	2n50 CR
8-4	**Temp Over Range**: Process temperature is over range	2n50 CR
8-5	**Redun Backup Temp:** (FUTURE – Consult with Honeywell for meaning)	----
8-6	**Temp Correct Active**	2n48 NC
8-7	**Temp Sensor Mismatch**	2n50 CR

NC = Non-Critical Alarm **CR =** Critical Alarm Override Action Considered
NOTE: The 'n' in the Modbus address refers to the number of the meter run

Transducer Alarms Logged by the Flow Computer

Table 2 alarm points are automatically updated with data contained in the 'detailed status' bytes within the flow computers copy of the SMVs data base. These alarms are time and date tagged and logged by the flow computer whenever the respective bit changes state. Other than the logging function, non-critical alarms cause no other action to occur. Critical alarms are alarms which are considered to adversely impact the credibility of the measurement reading, these alarms cause the flow computer to examine the 'Override Code' strategy and apply an override if so configured.

Table 2. Alarm Points

ADDRESS OF ALARM POINT	ALARM TITLE	ALARM TYPE
2n42	Meter 'n' DP: Invalid Corrects or Corrects Reset	NC
2n43	Meter 'n' DP is the Input or Output Mode	CR
2n44	Meter 'n' DP Signal is Suspect	CR
2n45	Meter 'n' Pressure: Invalid Corrects or Corrects Reset	NC
2n46	Meter 'n' Pressure is in the Input or Output Mode	CR
2n47	Meter 'n' Pressure Signal is Suspect	CR
2n48	Meter 'n' Temperature – Invalid Corrects or Corrects Reset	NC
2n49	Meter 'n' Temperature is in the Input or Output Mode	CR
2n50	Meter 'n' Temperature Signal is Suspect	CR
2n51	Meter 'n' Body Fault – Over Temperature	NC
2n52	Meter 'n' Critical Failure of SMV Electronics	CR
2n53	Meter 'n' SMV Not Communicating	CR

NC = Non-Critical Alarm **CR =** Critical Alarm Override Action Considered
NOTE: The 'n' in the Modbus address refers to the number of the meter run

HV Combo Module Address Jumpers

The HV Combo Module uses the same physical PCB module as a regular H type combo module, except it uses a different address jumper setting (Figure 1).

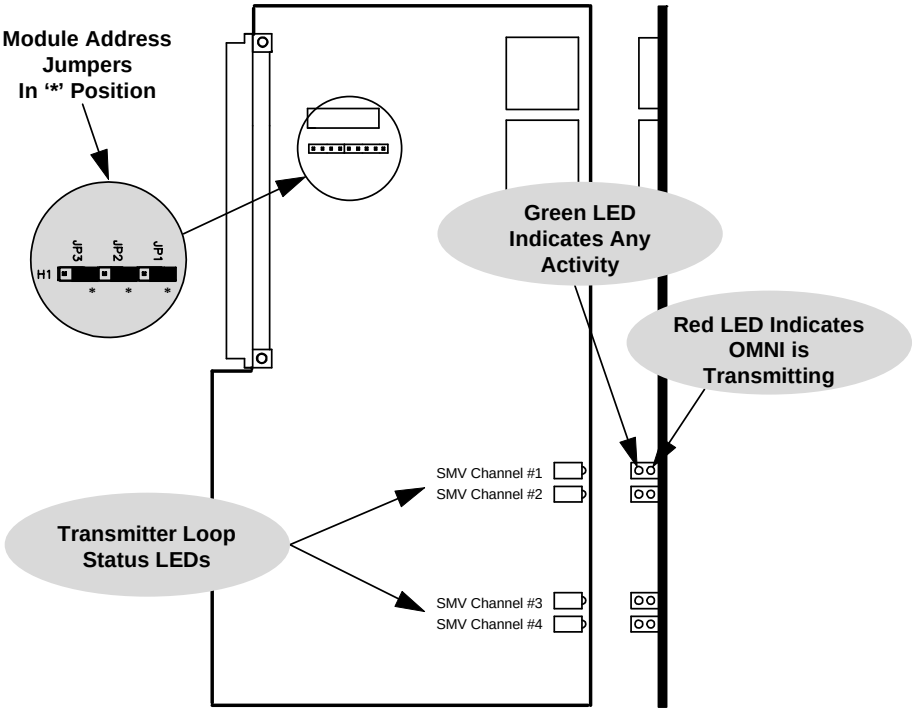

Figure 1. Setting the Address Jumpers of the HV Combo Module

How the I/O Points are Assigned

When the flow computer detects that an 'HV' combo module is installed it automatically allocates twelve (12) of its twenty-four (24) process inputs to the 'HV' module. The presence or absence of combo modules is checked after a RESET ALL RAM or after a CHECK I/O MODULES command is executed. Although the 'HV' combo has only four (4) physical Honeywell DE ports, each SMV- 3000 provides three (3) variables for a total I/O requirement of 4 x 3 = 12. As the total process input count of the flow computer is limited to twenty-four (24) it is obvious that if an 'HV' combo module is fitted there can only be three (3) other combo modules of type A, B, E/D, E or H. The 'HV' combo module is always the last module in the list, and the I/O assignments reflect this fact.

Example 1: OMNI 6000 - 2A - H1 – HV (Flow computer contains - 2 'A' combos, 1 'H' combo, and an 'HV' combo).

The 1st 'A' combo is allocated:	Input points	1, 2, 3 & 4
	Output points	1 & 2
The 2nd 'A' combo is allocated:	Input points	5, 6, 7 & 8
	Output points	3 & 4
The 'H' combo is allocated:	Input points	9, 10, 11 & 12
	Output points	5 & 6
The 'HV' combo is allocated:	Input points	13, 14, 15 & 16 Diff. Pressure
		17, 18, 19 & 20 Temperature
		21, 22, 23 & 24 Pressure
	Output points	7 & 8

While the example shown employs four (4) combo modules in total, it uses all twenty-four (24) process input assignments, this means that tow (2) physical I/O module slots will be unusable on the backplane.

To configure an 'HV' combo module it is only necessary to configure the Diff-Pressure I/O points in the Meter Run Config menu, the I/O points for the temperature and pressure variables are automatically assigned by the flow computer and cannot be changed by the user.

Using Example 1 Table 3 identifies the I/O point assignments that will occur.

Table 3. I/O Point Assignments

	DIFFERENTIAL PRESSURE	TEMPERATURE	PRESSURE
METER RUN # 1	**13**	*17*	*21*
METER RUN # 2	**14**	*18*	*22*
METER RUN # 3	**15**	*19*	*23*
METER RUN # 4	**16**	*20*	*24*

Numbers in **bold** are entered by the user. Numbers in *italics* are assigned automatically by the flow computer and cannot be changed.

OMNICOM Revision

OMNICOM revision 74 or later is required to support the SMV-3000 multivariable transmitter.

DOCUMENT REVISION HISTORY

DOCUMENT INITIAL RELEASE DATE.....22-May2003

REVISION	DATE	PURPOSE / CHANGE REQUEST
A	22-May-2003	Maintained on the Web - Initial release
B	12-April-2009	DCR 090110