SUBJECT: SPI COMMANDS FOR TEMPERATURE CONTROL UNITS
AND PORTABLE WATER CHILLERS

FYI #326   08/14/2018

INTRODUCTION

In 1987 a group of member companies of the Society of the Plastics Industries began development of a communication protocol for use by their processing and auxiliary equipment. Their goal was to allow the exchange of information between various pieces of equipment from different manufacturers to be simple and reliable. The result of their work was released in 1990 and has made the interconnection of equipment much easier and straightforward. There are now over 40 companies that offer the SPI Protocol in their products.

RS-485 communications port used on Instruments for SPI communications.

PROTOCOL BASICS

The SPI Protocol is described by a 2 part specification. The largest portion of the SPI Protocol specification deals with how basic information is exchanged between equipment. The second part of the specification details the actual pieces of information exchanged using the protocol. Items such as Process Temperature, Process Setpoint and Process Status are detailed in this part. **This FYI will list the commands that are supported by Advantage equipment.**

EQUIPMENT SETUP

The setup of equipment to be connected in an SPI Protocol network is simple. Each device must have a unique address for its device type and it must use the same data transfer rate as the other pieces of equipment in the network. There are many acceptable ways used to 'set' the device address and data rate. **Advantage** equipment provides access to the information via the front panel operators and displays. Other manufacturers may use internal DIP switches or jumpers. A typical cell may be configured as follows:

> Data Transfer Rate: 9600 bits per second (bps)
>
> Mold Temperature Controller (Qty 2): Addresses 1 and 2
>
> Chiller (Qty 1): Address 1

Note in the above example that different device types may have the same address. This is because the SPI Protocol uses the device type as part of its internal address.

NETWORK TROUBLESHOOTING

Troubleshooting a network is best done by verifying the setup of each piece of equipment and insuring that the network is installed with the correct electrical interconnection. Here are some basic things to do if equipment isn't 'talking' as expected.

1. Verify that each piece of equipment is properly grounded to its power source.

2. Inspect cables inside and outside the electrical cabinet. Repair or replace as necessary. The cable scheme used by most manufacturers allows the communication signals to 'pass through' each piece of equipment. Therefore, when a piece of equipment is disconnected from the middle of the network, all the equipment 'after' that one will be disconnected, too. If a piece of equipment is being permanently removed, the device cables should be rearranged at the molding machine to reconnect the other equipment.

3. Check the Data Transfer Rate and Address of each piece of equipment. For example, if both Temperature Controllers have the same address, they will both try to 'talk' at the same time and garble each other's data.

4. Verify the network is properly terminated and that it is configured as a 'multi-drop'. This is best achieved by following the molding machine manufacturer's installation instructions and use extension cables provided by them or us.

5. Attach each device, singly, to the molding machine and see if it 'talks'. Add additional devices until a problem is seen.
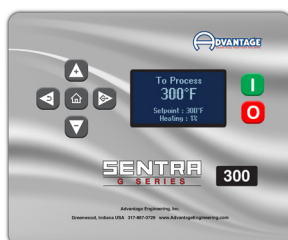
SPI Register Definitions for Sentra Temptender, Sentra G, Sentra G-300 & Sentra T-300 Control Instruments

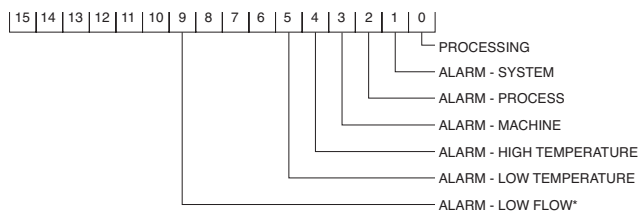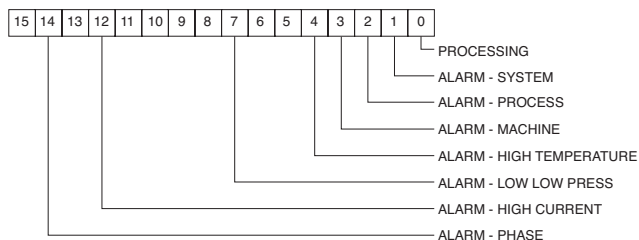Sentra G Series

Sentra Temptender
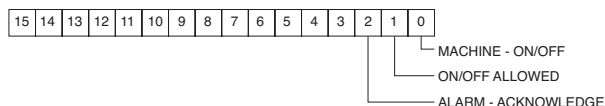
Sentra G-300 Series

Sentra T-300

POLL C1 C2	SELECT C1 C2	COMMAND	DESCRIPTION
20 20	20 21	Echo	Controller integrity command
20 20		Version	Controller version command
20 30	20 31	Setpoint	Desired process temperature
20 32		High temp	Hi temperature deviation alarm
20 34		Low temp	Low temperature deviation alarm
20 36	20 37	Flow Alarm	Low flow alarm setpoint*
20 40		Status Process	

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- PROCESSING
- ALARM - SYSTEM
- ALARM - PROCESS
- ALARM - MACHINE
- ALARM - HIGH TEMPERATURE
- ALARM - LOW TEMPERATURE
- ALARM - LOW FLOW*

POLL C1 C2	SELECT C1 C2	COMMAND	DESCRIPTION
20 42		Status Machine 1	

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- PROCESSING
- ALARM - SYSTEM
- ALARM - PROCESS
- ALARM - MACHINE
- ALARM - HIGH TEMPERATURE
- ALARM - LOW LOW PRESS
- ALARM - HIGH CURRENT
- ALARM - PHASE

POLL C1 C2	SELECT C1 C2	COMMAND	DESCRIPTION
20 4A	20 4B	Protected mode - machine	

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- MACHINE - ON/OFF
- ON/OFF ALLOWED
- ALARM - ACKNOWLEDGE

POLL C1 C2	SELECT C1 C2	COMMAND	DESCRIPTION
20 70		Temperature to process	
20 72		Temperature from process*	
20 78		Flow rate from unit GPM	
20 E0		Blanket Poll	
	Returns:	20 30	Setpoint
		20 32	High alarm deviation
		20 34	Low alarm deviation
		20 40	Status process
		20 70	To process temperature

POLL C1 C2	SELECT C1 C2	COMMAND	DESCRIPTION
20 44		Status Machine 2	

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- PROCESSING
- ALARM - SYSTEM
- ALARM - PROCESS
- ALARM - MACHINE
- ALARM - SENSOR

SPI Register Definitions for Maximum MG, MK-LE and MK-HE Control Instruments
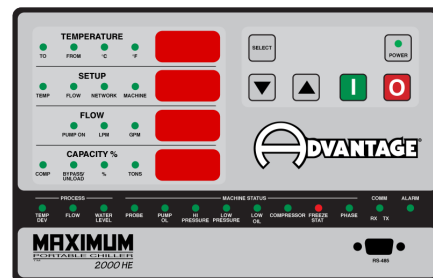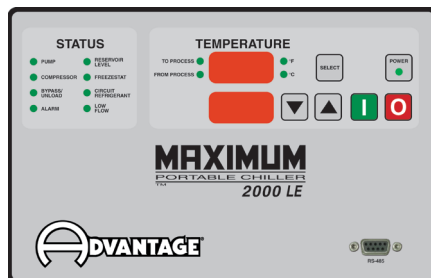
POLL	SELECT		
C1 C2	C1 C2	COMMAND	DESCRIPTION
20 42			Status Machine 1
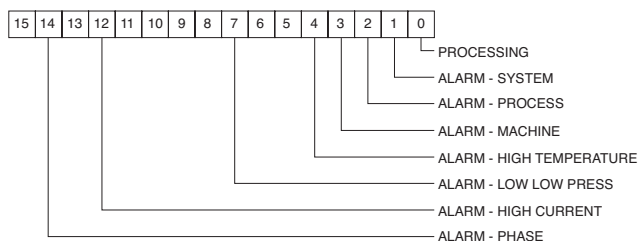
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- PROCESSING
- ALARM - SYSTEM
- ALARM - PROCESS
- ALARM - MACHINE
- ALARM - HIGH TEMPERATURE
- ALARM - LOW LOW PRESS
- ALARM - HIGH CURRENT
- ALARM - PHASE

POLL	SELECT		
C1 C2	C1 C2	COMMAND	DESCRIPTION
20 44			Status Machine 2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- PROCESSING
- ALARM - SYSTEM
- ALARM - PROCESS
- ALARM - MACHINE
- ALARM - SENSOR
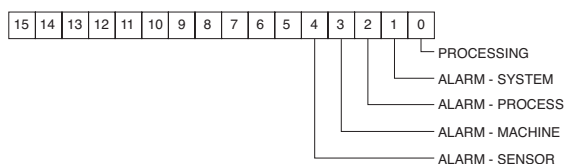
POLL	SELECT		
C1 C2	C1 C2	COMMAND	DESCRIPTION
20 48	20 49		Machine
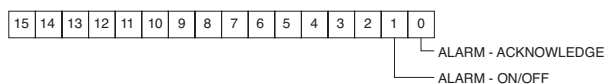
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- ALARM - ACKNOWLEDGE
- ALARM - ON/OFF

POLL	SELECT		
C1 C2	C1 C2	COMMAND	DESCRIPTION
20 70			Temperature to process
20 72			Temperature from process
			Blanket Poll
		Returns: 20 30	Setpoint
		20 32	High alarm deviation
		20 34	Low alarm deviation
		20 40	Status process
		20 70	To process temperature
20 E2			Maximum chiller status (version 1.12 and above)

POLL	SELECT		
C1 C2	C1 C2	COMMAND	DESCRIPTION
20 20	20 21	Echo	Controller integrity command
20 20		Version	Controller version command
20 30	20 31	Setpoint	Desired process temperature
20 32		High temp	Hi temperature deviation alarm
20 34		Low temp	Low temperature deviation alarm
20 36	20 37	Flow Alarm	Low flow alarm setpoint*
20 40			Status Process

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- PROCESSING
- ALARM - SYSTEM
- ALARM - PROCESS
- ALARM - MACHINE
- ALARM - HIGH TEMPERATURE
- ALARM - LOW TEMPERATURE
- ALARM - LOW FLOW*

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- PROCESS
- ALARM - SYSTEM
- ALARM - PROCESS
- ALARM - MACHINE
- LOW WATER LEVEL
- ALARM - PRO. PUMP
- ALARM - EVAP. PUMP
- ALARM - OIL PRESS
- CRANKCASE HEATER
- CYLINDER UNLOAD**
- 3 HEAD***
- COMP. DELAY
- COMP ON
- HGBP ON
- CYL 1 OR 2 ON
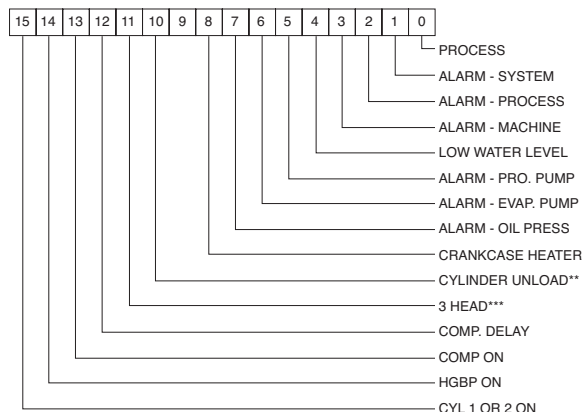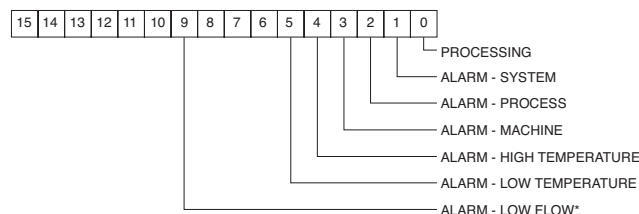
POLL	SELECT		
C1 C2	C1 C2	COMMAND	DESCRIPTION
20 E4			Remote temperature (version 1.12 & above)
20 E6			Evaporator temperature (version 1.12 & above)
20 E8			Media temperature (version 1.12 & above)
20 EA	20 EB		Freezestat temperature (version 1.12 & above)

** Cylinder unloading is 0x400. Standard chiller is 0

*** This is valid for cylinder unloading only. 3 head is 0x0x800. 2 head is 0