



Application Bulletin: #155

Date: October 19, 2007

Sentinel I24 Digital Input and Output Configuration

The Sentinel I24 can communicate with external hardware using digital inputs and outputs. There are 12 input and 8 output terminals available on the I/O board mounted inside the instrument. The 8 sourcing outputs are solid state relays. As a group they are fused for 6.3 amps. The 12 inputs are sinking. They can be wired directly to pushbuttons, proximity switches, lights, relays, solenoid valves, etc. or to a PLC for the interface or control of the process that the instrument is monitoring. The I/O board can be specified for 24 VDC (blue board) or 120 VAC (green board). The power for the I/O board should be supplied independent of the main instrument power or the internal power supply. This allows the tooling control I/O to be independent of instrument power for emergency stop and other safety considerations. The internal power supply does not have enough power to drive all possible I/O requirements.

Because of the variety of functions that these inputs and outputs perform and because they are independently programmed within each part program, they are divided into two general types: Universal and Part Program Specific. Universal inputs or outputs are functions shared by all part programs so when selected within one part program their function is automatically assigned to that terminal for all other part programs. These inputs and outputs are usually hard wired to a Start button or Part Result light that serves the same function for every part programmed in the instrument. The remaining inputs and outputs are selected specifically for the part program where they are picked. There are groups of outputs that can share a terminal and have different functions depending on the part program. This provides the flexibility to have defined inputs and outputs only operate within certain part programs. For instance there may be several tooling valves that operate cylinders for sealing parts. Within each part program selected cylinders can be picked to seal a unique combination of holes in the test part. If the sequence of using a group of tooling cylinders is different from part program to part program, the tooling sequence numbers will change for those inputs and outputs. Physically the wiring to the tooling cylinders will not change but the designation as to motion 1, motion 2, etc. will be different for various cylinders as needed to clamp and seal a part.

DIGITAL INPUT CONFIGURATION

Part Num 123	units	<INPUTS>	outputs
I/O No 73245900			
Input 1	Unassigned	Input 5	Unassigned
Input 2	Unassigned	Input 6	Unassigned
Input 3	Unassigned	Input 7	Unassigned
Input 4	Unassigned	Input 8	Unassigned
			6 P01

The standard Sentinel I24 has twelve digital input terminals within the enclosure. Each terminal should be defined for wiring purposes before completing this program. Select the use of these inputs within each part program. If an input is not used within the program, select Unassigned. If the input was assigned to a Universal input within another program, it will be automatically assigned within all other part programs. If the input terminal is assigned to one of the Part Program Specific functions within any part program, "Constrained" will appear on that Input terminal in all other part programs until that terminal is assigned a function from within its part program specific group. The programming of the functions in the "tooling" screen defines the available inputs in the Inputs screen. For instance if "Part Mark Fdbk" is programmed in "Tooling", this input will be available for assignment to a terminal. In addition the number of tooling motions selected along with the types of feedback will set the available Extend and Retract Feedback inputs available. The complete list of available inputs follows:

Universal Inputs (Automatically set within all part program when defined in any one program.)

Test Cycle Inputs	Test Result Inputs	Binary Part Program Selection Inputs
Start Station	SPC Test Part	Part Select B1
Common		Part Select B2
Stop/Reset Station		Part Select B3
Hold		Part Select B4
Vent/Halt		Part Select B5
		Part Select B6
		Part Select B7

Part Program Specific Inputs (Individually set within each part program. Different inputs within a group can be assigned to the same input terminals within other part programs.)

Auto Cal Group	Part Control Group	Leak Std Group	Test Control Group	Test Result Group	Tooling Control Extend Group	Tooling Control Retract Group
AutoCal	Part Present	Open Leak Std	Ext Press Sw	Part Mark Fdbk	Tooling Extend Feedback 1	Tooling Retract Feedback 1
			Ext Press Sw2		Tooling Extend Feedback 2	Tooling Retract Feedback 2
					Tooling Extend Feedback 3	Tooling Retract Feedback 3
					Tooling Extend Feedback 4	Tooling Retract Feedback 4
					Tooling Extend Feedback 5	Tooling Retract Feedback 5

Binary Part Program Select Inputs

Binary inputs are Universal inputs that remotely select the new part program. The number of Binary Input terminals required depends on the highest part number that is to be accessed. One part program (1 terminal), 2 or 3 programs (2 terminals), 4-7 programs (3 terminals), 8-15 programs (4 terminals), 16-31 programs (5 terminals), 32-63 programs (6 terminals), 64-99 (7 terminals). The inputs must be appropriately set before the start signal is sent. If all binary part program select inputs are low, the instrument tests using the last part program selected.

Tooling Control Feedback

Tooling Control Feedback inputs are Part Specific. The number of tooling motions and the feedback requirements for each motion must be set in the “Tooling” menu (described later in this bulletin) before assigning those motions and feedback in the Digital Input and Output menus.

Within each part program the number sequence of the tooling motions is always 1, 2, 3, etc. The input terminal assigned to the selectable “Tooling Extend Feedback 1, 2, 3, etc” and “Tooling Retract Feedback 1, 2, 3, etc” signal is defined by where that physical signal is wired. Therefore Input terminal 5 may be assigned as “Tooling Extend Feedback 1” in one part program and “Tooling Extend Feedback 3” in another. They are receiving the same input signal but the order in which the part program is expecting that signal varies based on how the tooling is used by that particular part program.

See the programming options under the Tooling tab where the number of tooling motions, feedback requirements, and part mark requirements are defined for each part program.

Digital Input	Description
	Test Input Functions
	Universal Inputs
Start Station	Initiates the testing function
Start Common	Second start input required when operating tooling control with anti-tie-down start (for anti-tie two inputs, must be within 0.05 to 0.5 seconds)
Stop/Reset Stn	Advances the test immediately to the exhaust cycle and then releases tooling in sequence (if selected). A required input when tooling is not released for reject test results.
Hold	Pauses the test cycle within any phase of test sequencing. When the Hold input is released, the test resumes.
Vent/Halt	Advances the test immediately to the exhaust cycle but does not release any tooling motion. A separate Stop/Reset Stn input is required to release the tooling motions to the home position.
SPC Test Part	If this input is high when the Start Test input is received, the test results will be identified as an SPC part by an “*” in the test result data and on the TEST DATA screen. Used to sort test results and identify special SPC part.
	Part Program Specific Inputs
Part Present	This input must be high when the start test input is received or it must be received within one of the selected tooling extend motions. It must go low between part tests.
Ext Press Sw	Digital input must be received before the end of the fill cycle in order to continue the test cycle. This could be an external pressure verification signal or some poki-yoki test.
AutoCal	Remotely initiates the Auto Cal routine. Also requires the Start input(s) when the master part is positioned in the fixture and ready for testing.
Open Leak Std.	Opens the Leak Std Calibration valve during complete test cycle to add the Leak Std to the test circuit.

Binary Part Selection Inputs	
	Universal Inputs (Number of required inputs depends on highest part number to be selected.)
Part Select B1	One binary input for 1 part program
Part Select B2	Two binary inputs for 3 part programs
Part Select B3	Three binary inputs for 7 part programs
Part Select B4	Four binary inputs for 15 part programs
Part Select B5	Five binary inputs for 31 part programs
Part Select B6	Six binary inputs for 63 part programs
Part Select B7	Seven binary inputs for 99 part programs

Tooling Control Feedback Inputs	
	Part Specific Inputs (Dependent on number of motions and feedback selected in “Tooling” tab for the part program)
Part Mark Fdbk	Feedback signal goes high before the end of the Part Mark timer. The Retract tooling sequences cannot start until this input is received.
Tooling Extend Feedback 1	Receive feedback for Tooling Extend Motion 1 by end of timer before starting next tooling motion or starting test.
Tooling Extend Feedback 2	Receive feedback for Tooling Extend Motion 2 by end of timer before starting next tooling motion or starting test
Tooling Extend Feedback 3	Receive feedback for Tooling Extend Motion 3 by end of timer before starting next tooling motion or starting test
Tooling Extend Feedback 4	Receive feedback for Tooling Extend Motion 4 by end of timer before starting next tooling motion or starting test
Tooling Extend Feedback 5	Receive feedback for Tooling Extend Motion 5 by end of timer before starting starting test
Tooling Retract Feedback 1	Receive feedback for Tooling Retract Motion 1 by end of timer before signaling end of test cycle.
Tooling Retract Feedback 2	Receive feedback for Tooling Retract Motion 2 by end of timer before starting next tooling motion.
Tooling Retract Feedback 3	Receive feedback for Tooling Retract Motion 3 by end of timer before starting next tooling motion.
Tooling Retract Feedback 4	Receive feedback for Tooling Retract Motion 4 by end of timer before starting next tooling motion.
Tooling Retract Feedback 5	Receive feedback for Tooling Retract Motion 5 by end of timer before starting next tooling motion.

Tooling Control Functions

Tooling Extend Feedback 1

Tooling Extend Feedback 2

Tooling Extend Feedback 3

Tooling Extend Feedback 4

Tooling Extend Feedback 5

The Sentinel I24 instrument can be programmed for up to five sequential tooling motions with or without feedback within the “tooling” tab of each part program. If programmed for feedback the instrument will monitor the selected inputs to go high before the appropriate feedback timer (time programmed in the “timer” tab) expires to indicate the completion of that sequential tooling motion. These tooling motion feedback signals are typically provided by pressure switches, proximity switches, or photo-eyes.

Tooling Retract Feedback 1
Tooling Retract Feedback 2
Tooling Retract Feedback 3
Tooling Retract Feedback 4
Tooling Retract Feedback 5

If the part program is set for tooling control with feedback, there are feedback signals for each programmed tooling motion when they reach the extend position and then return to the home position. The selection of feedback (none, extend, retract, or both) is individually programmed for each motion. There is one feedback for each tooling motion (up to 5). The instrument expects to receive each input (if selected) before the associated Tooling timer (Extend or Retract) expires before the next function can begin. Use this feedback to avoid tooling collisions or unsafe conditions.

Editing the Inputs

Unassigned and Constrained Inputs

Within Part Config, "Inputs", the inputs will either be "Unassigned", "Constrained", or assigned to one of the Universal or Part Program Specific Inputs.

Unassigned - No input within any part program has been assigned to this terminal. There is the full range of inputs available for selection.

Constrained - A Part Program Specific input has been assigned to this input within another part program. When attempting to edit the assignment of this terminal, only other input types within the same input group will be displayed for selection. In most cases no other option is available except Unassigned. When tooling feedback is involved, a specific feedback device may be a feedback for different tooling feedback motions depending on the sequence in which the tooling motions are used within different part programs. Therefore the same terminal can be assigned to another tooling motion feedback number within other part programs while the wiring of that input still goes to the same feedback device.

Programmed "Universal" Inputs – Within a program, if a terminal is already assigned to an input signal that is universal, it is common to all part programs. The choices are leave as is or "Unassign all parts". If "Unassign all parts" is selected, press ENTER and EDIT to re-assign the input to a different input function. This will also "Unassign" that terminal in all of the other part programs.

Programmed "Part Program Specific" Inputs – Within a part program, if a terminal is already assigned to a "Part Program Specific" input, only other "Part Program Specific" inputs within its group can be selected for that terminal. An example is a tooling extend or retract feedback signal. Each program can assign a unique feedback number to the same signal. When trying to change an assigned input from a programmed condition, press the EDIT key and use the arrow keys to sequence through the possible alternatives. To deactivate the use of this input terminal within this part program, select "Unassign". To change the input to a different function outside the previously selected group, first select "Unassign all part" and press ENTER. Then press EDIT key and use the arrow keys to sequence through the input choices to find the desired input function. But be aware that by selecting "Unassign all part", the input function is unassigned for all the other part programs until they are reassigned.

DIGITAL OUTPUT CONFIGURATION

Part Num 123	inputs	<OUTPUTS>	tooling
I/O No 73245900			
Output 1	Unassigned	Output 5	Unassigned
Output 2	Unassigned	Output 6	Unassigned
Output 3	Unassigned	Output 7	Unassigned
Output 4	Unassigned	Output 8	Unassigned
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Within each part program select the desired digital outputs for the assigned terminals on the Input/Output board as needed for the part program. If an output is not used within the program, leave “Unassigned”. If the output was assigned to a “Universal” output within another program, it will be already assigned within all the part programs. If the output terminal is assigned to one of the “Part Program Specific” functions within one of the other part programs, “Constrained” appears on the Output terminal and only similar outputs will be selectable on that terminal in other programs. This provides the flexibility to have defined outputs only operate within certain part programs. For instance there may be several tooling valves that operate cylinders for sealing parts. Within each part program selected cylinders can be picked for each particular part.

The standard Sentinel I24 has eight digital output terminals within the enclosure. The use of each terminal should be defined for wiring purposes before completing this program. See the Output Timing chart below for information about when the outputs occur. The outputs are “Universal” or “Part Program Specific”. Within the “Part Program Specific” outputs, there are Groups of outputs that can share the same digital output terminal between part programs. When programming the same terminal for different outputs the device receiving the output must be capable of interpreting the signal differently for different part programs. For applications where the different tooling motion numbers share a common output terminal, there is only one cylinder being actuated by the signal but the order in which it is actuated may be different from part to part. The available outputs are:

Universal Outputs (Automatically set within all part programs when defined in any one program.)

Test Cycle	Results
AutoCal Mode	Severe Leak 1
Test Lamp	(Severe Leak 2)
	Malfunction 1
	(Malfunction 2)
	Part Accept
	Part Reject

Part Program Specific Output Groups (Individually set within each part program. Different outputs within a group can be assigned to the same output terminals within other part programs.)

Test Cycle	Results	Test Control
Calibration Group	Part Mark Group	Tooling Control Outputs
AutoCal Master	Part Accept Mark	Tooling Extend 1
AutoCal LS	Part Reject Mark	Tooling Extend 2
In Cycle Group	Test Result Group	Tooling Extend 3
In Relax	(After 1st test)	Tooling Extend 4
(In 1st test)	Test Passed 1	Tooling Extend 5
In Pre-fill 1	Test Failed 1	Tooling Retract 1
In Fill 1	Below low limit 1	Tooling Retract 2
In Stab 1	Between limits 1	Tooling Retract 3
In Test 1	Above high limit 1	Tooling Retract 4
In Exhaust 1		Tooling Retract 5
Test Select 1		
(In sequential 2nd test)	(After sequential 2nd test)	
(In Pre-fill 2)	(Test Passed 2)	
(In Fill 2)	(Test Failed 2)	
(In Stab 2)	(Below low limit 2)	
(In Test 2)	(Between limits 2)	
(In Exhaust 2)	(Above high limit 2)	
(Test Select 2)		

2nd test outputs are only available for sequential testing

These outputs are programmed to go on during certain events of a typical test cycle for external use. The chart on page 11 shows the outputs for single pressure test configuration. Review the chart and decide which outputs perform the functions desired for your tests. These sourcing solid state relay outputs are fused as a group for 6.3 amps and can handle either 120 volts AC or 24 volts DC depending on I/O board supplied (green board – 120 VAC, blue board – 24 VDC). The Input/Output board is powered independent of the instrument power supply so that safety interlocks with emergency stop and light curtains will not shutdown instrument power.

Output Selections

Part Test Outputs

The outputs without numbers are common outputs for all the part programs. The outputs with a “1” suffix are specific to the test or first test in a dual sequential test station. The outputs with “2” are only available for dual sequence test types and apply to the second test (pneumatic manifold PC and PD and manifold options AF, DG, NK, PA and PB with electronic regulator).

Test Cycle Outputs

AutoCal Mode	Goes high during entire Auto Cal routine from start of first test until end of exhaust of second test. This output could be used to prevent normal machine cycling while AUTO CAL is being performed.
AutoCal Master	Goes high during first test of Auto Cal routine while testing the Master part.
AutoCal LS	Goes high during second test of Auto Cal routine while testing the Master part with the Leak Std included.
Test Lamp	This output will cycle on and off during the Pre-fill, Fill, and Stabilization timers and stays high during the Test timer.
In Relax	Goes high during the Relax timer in the Auto Setup, Auto Cal, or Auto Run routines.
Press Select 1	Goes high during the entire test sequence from start of Pre-fill timer 1 to the end of Exhaust timer 1.
In Pre-fill 1	Goes high during the Pre-fill cycle only. Could be used to activate an external fill valve to fill large volume parts quickly.
In Fill 1	Goes high during the Fill timer only
In Stab 1	Goes high during the Stabilization timer only
In Test 1	Goes high during the Test or detect timer only
In Exhaust 1	Goes high during the Exhaust timer only. Could be used to activate an external exhaust valve to prevent exhausting dirt or moisture from the part back through the instrument pneumatics.
	(Only available for second test of sequential test program)
Press Select 2	Goes high during the entire test sequence from start of Pre-fill timer 2 to the end of Exhaust timer 2.
In Pre-fill 2	Goes high during the Pre-fill cycle of second test only. Could be used to activate an external fill valve to fill large volume parts quickly.
In Fill 2	Goes high during the Fill timer of second test only
In Stab 2	Goes high during the Stabilization timer of second test only
In Test 2	Goes high during the test or detect timer of second test only
In Exhaust 2	Goes high during the exhaust timer of second test only. Could be used to activate an external exhaust valve to prevent exhausting dirt or moisture from the part back through the instrument pneumatics.

Test Result Outputs

	Part Results
Part Accept	Signals the completion of an accepted part test. For dual-test stations, this indicates that both tests passed. The output stays on until the start of next part test.
Part Reject	Signals the completion of a rejected part test. For dual-test stations, this indicates that either of the dual tests failed. The output stays on until the start of next part test.
Part Accept Mark	Goes high after exhaust and before the first tooling retract motion for the duration of the part mark timer. This signal could be used to trigger an accept marker.
Part Reject Mark	Goes high after exhaust and before the first tooling retract motion for the duration of the part mark timer. This signal could be used to trigger a reject marker.

	Test Results
Test Passed 1	Signals the completion of a first test that passed. For dual-test stations, Test Passed 1 output applies to the first and Test Passed 2 applies to the second test. This output stays on until the start of a new part test.
Test Failed 1	Signals the completion of a failed first test. For dual-test stations, Test Failed 1 output applies to the first and Test Failed 2 applies to the second test. This output stays on until the start of a new part test.
Below low limit 1	Goes high when test results are below the Low Limit set point and stays high until the start of a new part test.
Between limits 1	Goes high when test results are between the Low Limit and High Limit set points and stays high until the start of a new part test.
Above high limit 1	Goes high when test results are above the High Limit set point and stays high until the start of a new part test.
Severe Leak 1	Goes high at the end of exhaust for tests that fail to maintain Minimum Pressure within the Stabilization timer and stays high until the start of a new part test. The reject output also goes high for a severe leak.
Malfunction 1	Goes high at the end of exhaust for tests that fail to reach Minimum Test Pressure within Pre-fill timer, maintain pressure within the Minimum and Maximum Pressure limits during Fill timers, or any tooling or test failure during the complete testing cycle. It stays high until the start of a new part test.
	For second sequential test
(Test Passed 2)	Signals the completion of the second test that passed. For dual-test stations, Test Passed 1 output applies to the first test and Test Passed 2 applies to the second test. This output stays on until the start of a new part test.
(Test Failed 2)	Signals the completion of a failed second test. For dual-test stations, Test Failed 1 output applies to the first test and Test Failed 2 applies to the second test. This output stays on until the start of a new part test.
Below low limit 2	Goes high when second test results are below the Low Limit 2 set point and stays high until the start of a new part test.
Between limits 2	Goes high when second test results are between the Low Limit 2 and High Limit 2 set points and stays high until the start of a new part test.
Above high limit 2	Goes high when second test results are above the High Limit 2 set point and stays high until the start of a new part test.
Severe Leak 2	Goes high at the end of Exhaust 2 for tests that fail to maintain Minimum Pressure 2 during Stabilization timer and stays high until the start of a new part test.
Malfunction 2	Goes high at the end of Exhaust 2 for tests that fail to reach Minimum Test Pressure within Pre-fill timer, maintain pressure within the Minimum 2 and Maximum 2 Pressure limits during Fill 2, or any tooling or test faults and stays high until the start of a new part test.

Editing the Outputs

Unassigned and Constrained Outputs

With Part Config, “Outputs”, the outputs will either be “Unassigned”, “Constrained”, or assigned to one of the “Universal” or “Part Program Specific” Outputs.

Unassigned - No output within any part program has been assigned to this terminal. There is the full range of outputs available for selection.

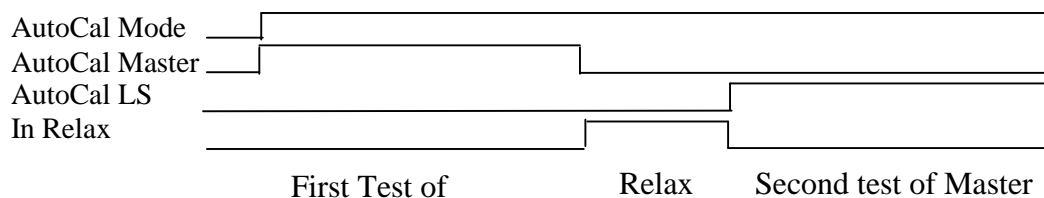
Constrained - A “Part Program Specific” output has been assigned to this output within another part program. When attempting to edit the assignment of this terminal, only other output types within the same output group will be displayed for selection. When tooling is involved, a specific device may provide a motion in a different sequence than tooling motions used within other part programs. Therefore the same terminal can be assigned to another tooling motion number within other part programs while the wiring of that output still goes to the same device.

Programmed “Universal” Outputs – Within a program, if a terminal is already assigned to an output signal that is “Universal”, it is common to all part program. The choices are leave as is or “Unassign all parts”. If “Unassign all parts” is selected, press ENTER and EDIT to re-assign the output to a different output function. This will also “Unassign” that terminal in all of the other part programs. If another “Universal” output is selected, it will apply to all of the other part programs. If a “Part Program Specific” output is selected, then that group of outputs will be available for that terminal in all of the other part programs.

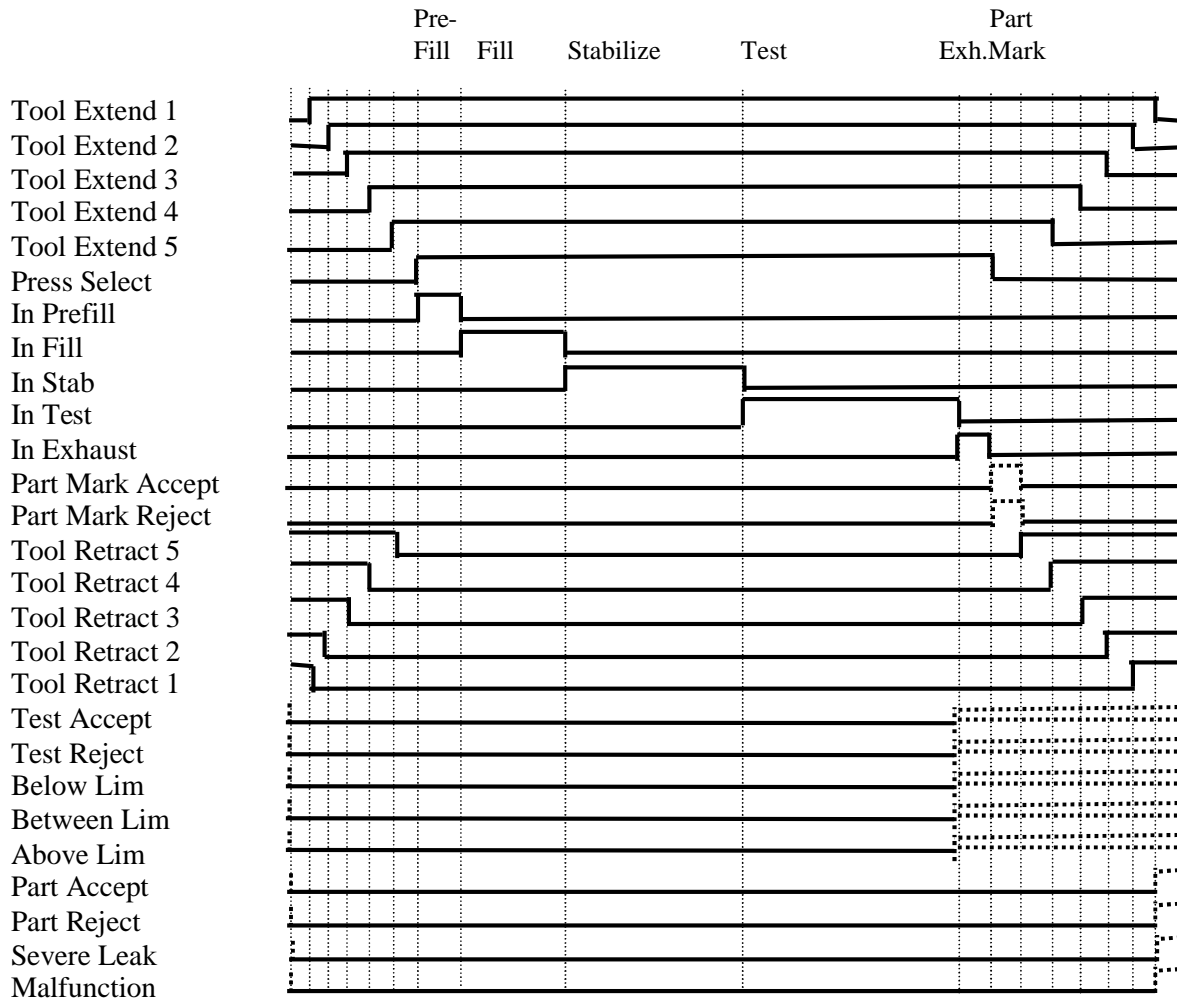
Programmed “Part Program Specific” Outputs – Within a part program, if a terminal is assigned to a “Part Program Specific” output, it will display “Constrained”. An example is a tooling extend or tooling retract output. Each program can assign a unique tooling motion number to the same signal. When trying to change an assigned output from a programmed condition, press the EDIT key and use the arrow keys to sequence through the possible alternatives. To deactivate the use of this output terminal within this part program, select “Unassign”. To change an output to a different function outside the previously selected group, first select “Unassign all part” and press ENTER. Then press EDIT key and use the arrow keys to sequence through the output choices to find the desired output function. But be aware that by selecting “Unassign all part”, the output function is unassigned for all the other part programs until they are reassigned.

TIMING CHARTS

Auto Calibration Cycle



Auto Calibration Digital Output Timing Chart



Single Test Digital Output Timing Chart

TOOLING CONFIGURATION

Part Num 123	outputs	<TOOLING>	tst type
>Tooling Option			Off
Number of Motions			1
Two Inputs to start			No
Anti-Tie-Down			No
Part Present Check			Start Test

Tooling setup screen

The Sentinel I-24 will support up to 5 sequential tooling motions with feedback, part mark with feedback, part present, and start test options. There are 12 digital inputs and 8 digital outputs to program within the Input and Output screens to interface these control functions with each part program. The number of tooling motions, feedback options, Start test options, Part presence options, and Part marking are set for each part program within the “Tooling” screens. Selections made on these screens define timer options for feedback and input and outputs selections found in the Inputs and Outputs screens.

Tooling Option (Disabled, Off, On)

Tooling Option provides progressive steps into implementing tooling control.

On - Implements all the tooling options selected on the Tooling Control, Timers, Input and Output screens into the test sequence.

Disabled - Prevents any tooling control settings from being implemented into the test sequence. Allows for the set up of all the variables on the Tooling Control screens and the Timer, Inputs, and Outputs screens

Off - Prevents any tooling control settings from being implemented into the test sequence. Allows for the set up of the Tooling Control screens only. Does not allow the tooling variables selected on Tooling Control screens to appear in Timer, Input, or Output screens. If the Tooling Option is changed to Off from Disabled or On, it will eliminate all input and output tooling motions and feedback signal programming for the inputs and outputs.

Number of Motions (0 to 5)

There are 0 to 5 tooling motions or control outputs available for each part program. Each part program can have a different number of tooling motions, different combination, and different sequence. The number of motions selected here will define how many feedback timers, feedback inputs, and tooling outputs appear in the Timers, Inputs, and Outputs screens. After defining the number of control outputs required and completing the remaining issues on the Tooling functions, go to the Output screen to program the sequence of outputs to the wired output terminals. This means that each program can use the output terminals in a unique order as required by the individual part programs. Next go to the Input screen to set the motion feedback signals to the tooling sequence as required for that part. Finally go to the Timer screen to set the appropriate feedback timers.

Two Inputs to Start (Yes or No)

This defines whether one or two inputs are required to start a test. With one input either the START key on the keypad or the digital input, Start, will initiate a test. For remote start inputs, one or two digital inputs, Start (and Common) must be wired on the digital input board and programmed to the corresponding terminals on the INPUT screen. Two inputs can be start pushbuttons or a start pushbutton and some gate or interlock input.

Anti-Tie-Down (Yes or No)

For operator safety, the Sentinel I24 can use a basic anti-tie-down start to initiate a test. This method requires that two inputs (Start and Common) go high within 0.05 to 0.5 seconds of each other and be held high until all the tooling motions are complete. This should keep the operator's hands away from the tooling while it is moving. The minimum timer prevents wiring the two inputs together or permanently making one of the inputs.

Part Presence Check (Test Start or After Tooling)

Motion Number (1 – 5)

Additional start test controls or component verification can be checked with a digital input signal indicating the presence of the part or component by monitoring for a high input before receiving a Start input or before receiving tooling feedback signal or end of feedback timer for the designated tooling motion. This can verify that a part is in the test fixture or provide one poki-yoki input signal. If the input must be received after a tooling motion, the motion number must be designated.

This function also requires that the input go low between test cycles.

Retract on Reject (Yes or No)

Upon completion of a leak test cycle involving tooling control, the tooling automatically retracts. In many instances it is advantageous to keep the part clamped and sealed for reject parts until the operator acknowledges its test status by using the Stop/Reset Stn input and also Common (when Anti-Tie-Down logic is imposed.) This will break the operator routine for reject parts so that they are less likely to sort the reject part into the accept bin. The tooling automatically retracts for all tests unless "Retract on

Reject” is enabled. If “Retract on Reject” is enabled, all reject and malfunction tests require the Stop/Reset to retract the tooling..

Part Mark (None, Accept, Reject, or Both)

At the completion of the exhaust timer, the Sentinel I24 can activate Part Mark output(s) for Accept Part, Reject Part, or Both.. These outputs activate at the end of the Exhaust timer and stay high for the duration of the Part Mark Timer set in the Timer tab. The Part Mark Accept and/or Part Mark Reject outputs must be assigned terminals in the Output tab.

- Tooling Feedback 1 (None, Extend, Retract, or Both)**
- Tooling Feedback 2 (None, Extend, Retract, or Both)**
- Tooling Feedback 3 (None, Extend, Retract, or Both)**
- Tooling Feedback 4 (None, Extend, Retract, or Both)**
- Tooling Feedback 5 (None, Extend, Retract, or Both)**

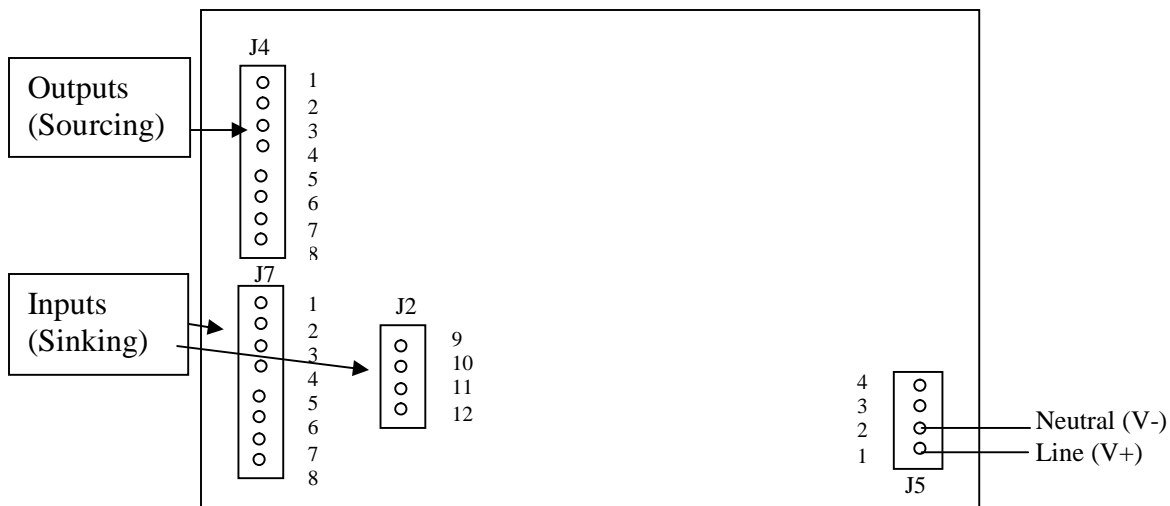
Each tooling motion selected can be interfaced uniquely into the control scheme of clamping and sealing the test part with selectable feedback inputs. Each Extend and/or Retract motion can use an Extend and/or Retract timer with or without an Extend and/or Retract digital input to control the sequential tooling motions to safely and reliably seal the part for testing. When the desired feedback is defined for each tooling motion, the timers for those motions will be displayed for adjustment in the Timers screen(s). Tooling feedback for the Extend and Retract motions can be:

- no feedback but a feedback timer delay between motions for the selected tooling control
- Feedback input before the Feedback timer for Extend Tooling Feedback only
- Feedback input before the Feedback timer for Retract Tooling Feedback only
- Feedback inputs before the Feedback timers expire for both Extend and Retract Tooling Feedbacks

Part Mark Feedback (No or Yes)

If Part Mark (Accept, Reject, or Both) is selected, there is an option for Part Mark Feedback. To verify that the Part Mark action is complete, a Part Mark Feedback input is available to validate the Part Mark action before beginning any Retract Tooling action. This can confirm that any tooling involved in the marking action is out of the way before moving other tooling. This digital input must be assigned to the appropriate terminal in the Input screen.

All the Digital Inputs and Outputs must be wired to the 12 input and 8 output terminals on the top I/O circuit board.



Input/Output Board

The Sourcing Outputs are wired from the output terminals to the relay, solenoid, light, etc and back to Neutral (V-). The Sinking Inputs are wired from the input terminals to the switches, relays, photo-eyes, etc to the Line (V+) terminal. The 24 VDC or 120 VAC power for the inputs and outputs are not supplied by the instrument. Because there is only one Neutral (V-) and one Line (V+) screw terminal on the I/O board, it is advisable to have external terminals for these common connections for the supply voltage and neutral for the inputs and outputs.

Pre-wired Cable Package for I/O and Communication

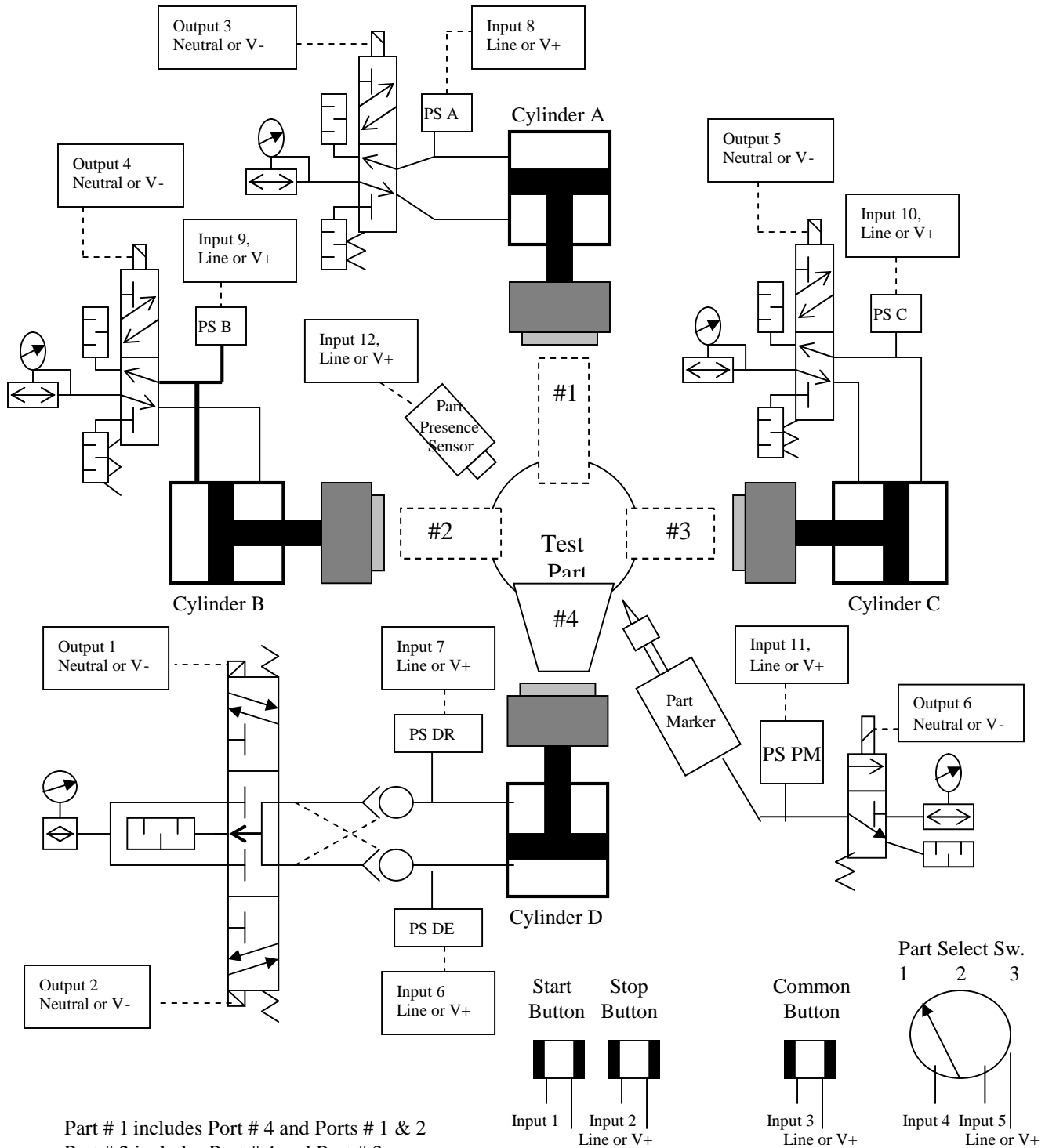
To simplify the wiring of the digital inputs and outputs, an Industrial Cabling package is offered as an option. The package provides a 26 conductor wiring harness connected to the two digital input terminal blocks (J7 and J2), one digital output block (J4), and the power connector block (J5). The diagram below indicates the internal termination, wire color code, and function of each pin for the 26 pin I/O cable and connector.

Turck Pin #	Wire Color	Function	Internal plug	Internal plug AC power	Internal plug DC power
2	White/Gray	Input 1	J7 pin 1		
3	Blue/Gray	Input 2	J7 pin 2		
4	Brown/Gray	Input 3	J7 pin 3		
16	Black/Gray	Input 4	J7 pin 4		
17	Brown/Orange	Input 5	J7 pin 5		
18	White/Orange	Input 6	J7 pin 6		
19	Black/Orange	Input 7	J7 pin 7		
24	Blue/Orange	Input 8	J7 pin 8		
5	Black/Yellow	Input 9	J2 pin 1		
6	White/Yellow	Input 10	J2 pin 2		
7	Blue/Yellow	Input 11	J2 pin 3		
8	Brown/Yellow	Input 12	J2 pin 4		
1	Brown	V+			J5 pin 1
9	Black/Red	Output 1	J4 pin 1		
10	White/Red	Output 2	J4 pin 2		
11	Blue/Red	Output 3	J4 pin 3		
12	Brown/Red	Output 4	J4 pin 4		
20	Black/Green	Output 5	J4 pin 5		
21	White/Green	Output 6	J4 pin 6		
22	Blue/Green	Output 7	J4 pin 7		
23	Brown/Green	Output 8	J4 pin 8		
13	Black	Line		J5 pin 1	
14	White	Neutral		J5 pin 2	
15	Blue	V-			J5 pin 2
25	Green/Yellow				
26	N/C				

Input/Output Connector cable and pinouts

Example of a Tooling Control Application

Test application involves a family of three parts which share common features but also have one or two unique features. All three parts can be tested in a common fixture but require individualized tooling actions to seal the part



Line (or V+) and Neutral(or V-) source power should be supplied independent of the instrument's incoming power or internal power supply.

Setup for tooling control

Because there are motions involving potential pinch points for the tooling, two input start with a form of anti-tie-down start is desired. All accept parts are to be marked. If a part is rejected, the tooling should not release until the operator acknowledges the reject. The desired part test program and associated tooling control required for each part should be selected by a binary coded selector switch. The control valves for Cylinders A, B, and C are spring-return 4-way valves. The valve for cylinder D is a dual solenoid, 3 position spring return valve.

Programming of Sentinel I24 to perform the required tooling control for each part

The programming for the tooling control for each part is performed within the “Part Config” menu for each part as required. Because each part requires different tooling motions, the part programs will be different. The following table shows the set up required for operating the tooling to these parts.

Part Config, “TOOLING”

	Part #1	Part #2	Part #3
Tooling Motion	On	On	On
Number of Motions	3	2	3
Two Inputs to Start	Yes	Yes	Yes
Anti-Tie-Down	Yes	Yes	Yes
Part Presence Check	Yes	Yes	Yes
Retract on Reject	No	No	No
Part Mark	Accept	Accept	Accept
Tooling Feedback 1	Both	Both	Both
Tooling Feedback 2	Extend	Extend	Extend
Tooling Feedback 3	Extend		Extend
Mark Severe Lk Rej	No	No	No
Part Mark Feedback	Yes	Yes	Yes

Part Config, “INPUT”

Input Terminal	Hardware	Part #1	Part #2	Part #3
Terminal #1, J7	Start button	Start Station	Start Station	Start Station
Terminal #2, J7	Stop button	Stop/Reset Stn	Stop/Reset Stn	Stop/Reset Stn
Terminal #3, J7	Common button	Common	Common	Common
Terminal #4, J7	Part select sw	Part Select B1	Part Select B1	Part Select B1
Terminal #5, J7	Part select sw	Part Select B2	Part Select B2	Part Select B2
Terminal #6, J7	PS DE	Tool Ext Fdbk 1	Tool Ext Fdbk 1	Tool Ext Fdbk 1
Terminal #7, J7	PS DR	Tool Ret Fdbk 1	Tool Ret Fdbk 1	Tool Ret Fdbk 1
Terminal #8, J7	PS A	Tool Ext Fdbk 2	Constrained	Constrained
Terminal #9, J2	PS B	Tool Ext Fdbk 3	Constrained	Tool Ext Fdbk 2
Terminal #10, J2	PS C	Constrained	Tool Ext Fdbk 2	Tool Ext Fdbk 3
Terminal #11, J2	PS PM	Park Mark Fdbk	Park Mark Fdbk	Park Mark Fdbk
Terminal #12, J2	Part Presence sensor	Part Presence	Part Presence	Part Presence

Part Config "OUTPUT"

Output Terminals	Hardware	Part #1	Part #2	Part #3
Terminal #1, J4	Cylinder D extend	Tool Extend #1	Tool Extend #1	Tool Extend #1
Terminal #2, J4	Cylinder D retract	Tool Retract #1	Tool Retract #1	Tool Retract #1
Terminal #3, J4	Cylinder A extend	Tool Extend #2	Constrained	Constrained
Terminal #4, J4	Cylinder B extend	Tool Extend #3	Constrained	Tool Extend #2
Terminal #5, J4	Cylinder C extend	Constrained	Tool Extend #1	Tool Extend #3
Terminal #6, J4	Part Mark Cylinder	Part Mark Accept	Part Mark Accept	Part Mark Accept
Terminal #7, J4				
Terminal #8, J4				