SECTION A
DISCRETE INPUTS

Revision Date: 12-12-24

DESCRIPTION OF OPERATION

Introduction

Discrete Inputs D1 - D30 are provided to allow for the connection of relay contacts, switch contacts or Level Probe inputs to the Controller to provide either a Control Function or to provide the input's status to SCADA or to do both. For Terminal Block numbers see page A-11.

Test Signal

Each of the Discrete Inputs send out a low voltage (+/- 6 V), low current (0.6 mA), AC (60 Hz) square wave as a Test Signal to determine the status of the input, either Open or Closed. No external power supply is required for the Discrete Inputs, they are self powered by the Test Signal which each Discrete Input sends out. The Status of the analog Test Signal for each of the Discrete Inputs may be viewed from Parameters A.101 - A.130. See page A-9.

Signal Common

The Signal Common for the Discrete Inputs is the Control Panel Ground. The Controller's Ground Terminal must be connected to the Control Panel Ground.

Operation

Relay Contacts or Switch Contacts

When a Discrete Input is used to determine the status of relay contacts or switch contacts, one side of the contacts must be connected to the Control Panel Ground and the other side of the contacts must be connected to a Discrete Input on the Controller.

If the relay contacts or switch contacts are open, then the Discrete Input's Test Signal has no path to the Control Panel Ground, and the input is considered Open.

If the relay contacts or switch contacts are closed, then the Discrete Input's Test Signal does have a path to the Control Panel Ground, and the input is considered Closed.

Level Probe

When a Discrete Input is used to determine liquid level and is connected to a Level Probe Electrode, the liquid must be grounded to the Control Panel Ground.

If the Level Probe Electrode is not touching the liquid (out of the liquid), then the Discrete Input's Test Signal has no path to Control Panel Ground, and the input is considered Open.

If the Level Probe Electrode is touching the liquid, then the Discrete Input's Test Signal does have a path to Control Panel Ground, and the input is considered Closed.

Please note that the Controller's Discrete Inputs are designed to read sewage very effectively but will not reliably read storm water or well water.

Sensitivity

The Sensitivity of the Discrete Inputs can be changed by the operator in groups of 10 inputs as shown:

Discrete Input Sensitivity: D1 - D10 Parameter F.141
Discrete Input Sensitivity: D11 - D20 Parameter F.142
Discrete Input Sensitivity: D21 - D30 Parameter F.143

The Standard Sensitivity (the default) setting is 100 which is the best setting for reading relay and switch contracts, and is also the best setting to reliably read typical sewage.

When Discrete Inputs are connected to a Level Probe, it may be necessary to increase the sensitivity. For extra sensitivity while reading light sewage, the Sensitivity Parameter of the Discrete Inputs connected to the Level Probe, can be changed to 150 or higher. See page A-8.

DESCRIPTION OF OPERATION

Determining Status

To determine the status of the Discrete Inputs the Test Signal sent out by each Discrete Input is measured and its analog value is compared to the setting of the respective Sensitivity Parameter (F.141, F.142 or F.143, See page A-8).

If the Test Signal is lower than the Sensitivity setting then the Discrete Input is considered Closed or “1”.

If the Test Signal is higher than the Sensitivity setting then the Discrete Input is considered Open or “0”.

The following show the normal range of the Test Signal values of Discrete Inputs connected to relay or switch contacts or to Level Probe Electrodes in typical sewage:

Test Signal of Open Discrete Input: 240 - 255. Test Signal of Closed Discrete Input: 55 - 70.

Status

The status of the Discrete Input Test Signals are available from Parameters A.101 - A.130. See page A-9.

The status of the Discrete Inputs as a discrete value (“0” or “1”) may be read by SCADA from Modbus Coils 1 - 30 (Register 40001 Bits 0 - 15 and Register 40002 Bits 0 - 13). See page A-10.

For Discrete Input Status on the SC5000-CTS-HMI see HMI screens on pages A-14 & A-15.
For Discrete Input Status on the SC5000-LED-HMI see Parameters n.01 - n.30 on page X-19.

Functions

The Discrete Inputs are assigned default Functions from the factory, but they may be changed by the operator using Parameters F.101 - F.130. If no Function is desired then the respective Parameter must be set for Function “0”.

While each of the Discrete Inputs may be assigned to perform a Function, if a Function is assigned to more than one input, the Fault indicator will come on and Fault Code 1018 will be generated. Function “0” is the exception to this rule. Any or all of the Discrete Inputs may be assigned Function “0”.

See page A-7 and see “DISCRETE INPUT FUNCTIONS” below for a description of each of the Functions.

DISCRETE INPUT FUNCTIONS

Collect Discrete Data for SCADA - Function 0

All of the Discrete Inputs collect data for SCADA, regardless of the Function assigned to them, but when a Discrete Input is assigned the Function of “Collect Discrete Data for SCADA” (Function 0) no other action (no Control Function) is performed by the Controller.

The status of all the Discrete Inputs may be read from Modbus Coils 1 - 30 (Register 40001 Bits 0 - 15 and Register 40002 Bits 0 - 13).

Level Probe Electrode 1 (2, 3, 4, 5, 6, 7, 8, 9, 10) - Functions 1 - 10

In the Level Control Mode only (Parameter P.091 = 1), the “Level Probe Electrodes 1 (2, 3, 4, 5, 6, 7, 8, 9, 10)” provide the liquid level status to a feature of the Controller called the “Level Probe Meter LPM1”.

To be used by the Controller to perform Level Control, the “Level Probe Meter LPM1” must be selected as the Level Input, by setting the “Level Input Select” parameter to “Level Probe Meter - LPM1” (Parameter P.133 = 5).

The “Level Probe Meter LPM1” requires connection to a Level Probe (having 10 Electrodes) using 10 Discrete Inputs assigned the Functions of “Level Probe Input - Electrode 1 - 10” (Functions 1 - 10).

The “Level Probe Meter LPM1” must be enabled and the Electrode Spacing must be established.

See Section L.

Pump 1 (2, 3, 4, 5, 6) Disable - Functions 11 - 16

When a Discrete Input assigned the Function of “Pump 1 (2, 3, 4, 5, 6) Disable” (Functions 11 - 16) is closed, the logic in the Controller considers the pump Disabled or not available for service and will not call the pump to run.

When a pump is Disabled the logic in the Controller will skip it in the pump call sequence and call the next available pump in its place.

With the Discrete Input Pump Disable Mode (Parameter F.145) set on “1” the Pump Disable Functions act to disable the respective pump when the Discrete Input is open rather than closed. See page A-8.

Discrete Inputs assigned Functions 11 - 16 are typically connected to pump fault contacts or pump out of service contacts such as contacts on an HOA switch that closes in the Off and Hand position. Pump fault contacts and pump out of service contacts may also be combined.

DISCRETE INPUT FUNCTIONS

All Pump Disable - Function 17

When the Discrete Input assigned the Function of “All Pump Disable” (Function 17) is closed, all pump operation will be disabled (not allowed to run), and Fault Code 1031 will be generated.

When the “All Pump Disable” Discrete Input opens, a 10 second Start Up Delay must first expire before the Controller will enable any pump operation. If a pump is turned on after the Start Up Delay, the Lag Pump Delay (Parameter P.150) must first expire before another pump is called to run, and before each additional pump is called to run.

A Discrete Input assigned Function 17 is typically connected to Phase Monitor contacts that are closed during a fault condition.

On Generator - Function 18

In cases where the Emergency Generator is not sized large enough to run all the available pumps, closing a Discrete Input assigned the Function of “On Generator” (Function 18) will limit the number of pumps called to run to the “Maximum Number of Pumps Allowed to Run While On Generator” (Parameter P.094).

A Discrete Input assigned Function 18 must be connected to contacts from the Generator Transfer Switch that close when on emergency power.

Switch Between ALM1 & ALM2 for Level Input - Function 19

The Controller has available two Analog Level Meters ALM1 and ALM2 that may be setup and used to provide a Level Input to the Controller’s Control Logic. Each of the Level Meters must have their own Analog Level Input, typically from two Pressure Transducers. However, the Level Control Logic can only use one Level Input at a time.

A Discrete Input assigned the Function of “Switch Between ALM1 & ALM2 for Level Input” (Function 19) may be used to manually switch from ALM1 to ALM2.

For this Function to operate the setting on the “Level Input Select” (Parameter P.133) must be set on 3:

Level Input Select = 3 - Manually switches from ALM1 to ALM2 when Discrete Input closes.

A Discrete Input assigned Function 19 is typically connected to contacts from a selector switch, or from relay logic. See Section M.

Start Flush Cycle - Function 20

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Start Flush Cycle” (Function 20) is closed the Flush Cycle will start.

A Discrete Input assigned Function 20 is typically connected to output contacts from an External Time Clock.

External Alternation - Group 1 - Function 21

Each time the Discrete Input assigned the Function of “External Alternation - Group 1“ (Function 21) transitions from open to closed, alternation of the pumps in Group 1 will occur. If no pumps were running when the Discrete Input is closed, the alternation of the designated lead pump will still occur.

A Discrete Input assigned Function 21 is typically connected to output contacts from an External Time Clock.

External Alternation - Group 2 - Function 22

In the Level Control Mode only (Parameter P.091 = 1), each time the Discrete Input assigned the Function of “External Alternation - Group 2“ (Function 22) transitions from open to closed, alternation of the pumps in Group 2 will occur. If no pumps were running when the Discrete Input is closed, the alternation of the designated lead pump will still occur.

A Discrete Input assigned Function 22 is typically connected to output contacts from an External Time Clock.

Sequence Input 1 (2, 3, 4, 5, 6) - Functions 31 - 36

When a Discrete Input assigned the Function of “Sequence Input 1 (2, 3, 4, 5, 6)” (Functions 31 - 36) is closed, the order that the pumps are called to run is fixed so that the selected pump is always the lead pump in the Group or Groups. Where the “Alternation Sequence Mode” (Parameter P.122) establishes the grouping of pumps into either one or two groups. See page A-12 & A-13.

Discrete Inputs assigned Functions 31 - 36 must be connected to contacts on either one or two lead selector switches.

DISCRETE INPUT FUNCTIONS

Call Pump 1 (2, 3, 4, 5, 6) Last - Functions 41 - 46

When a Discrete Input assigned the Function of “Call Pump 1 (2, 3, 4, 5, 6) Last” (Functions 41 - 46) is closed, it assigns the respective pump to standby status, where it will always be called to run last in its Group.

If more than one (but not all) of the pumps are assigned to standby status, they will be available to run if needed, but always after the pumps not assigned to standby status.

If all the pumps are assigned to standby status, then alternation will occur normally, as though none of them were assigned to standby status.

Discrete Inputs assigned Functions 41 - 46 are typically connected to relay logic contacts that close when it is imperative that the respective pump only run if necessary.

Flow Calculator - Start New Day - Function 47

In the Level Control Mode only (Parameter P.091 = 1), the Flow Calculator Mode (Parameter P.175) set for “External Time Clock”, the Flow Calculator logic will not issue the “Start New Day” command, it must be initiated externally once each day by an External Time Clock connected to a Discrete Input assigned Function 47.

A Discrete Input assigned the Function of “Flow Calculator - Start New Day” (Function 47) is typically connected to output contacts from an External Time Clock that is programmed to close its output contacts once every 24 hours.

Pump Cutoff - Low-Low Level (Pump Down Mode) - Function 59

When a Discrete Input assigned the Function of “Pump Cutoff - Low-Low Level“ (Function 59) is closed, the Low Level Alarm will be activated, pump operation will be disabled and Fault Code 1041 will be generated.

This feature will only operate in the Pump Down Mode (Parameter P.149 = 1).

Pump operation will not be re-enabled until the Low-Low Level input opens and the Pump Re-enable Delay - Pump Cutoff Low-Low Level (Parameter P.153) expires.

If an Output Relay (ROX1 - ROX12) is assigned Function 7, then the Output Relay’s contacts will be closed.

The status of the Low Level Alarm may be read from Modbus Coil 47 (Register 40003 Bit 14).

The status of the “Pump Cutoff Active Low-Low Level” may be read from Modbus Coil 131 (Register 40009 Bit 2).

A Discrete Input assigned Function 59 is typically connected to a Float Switch that closes upon a Low-Low Level condition.

Pump Cutoff - High-High Level (Pump Up Mode) - Function 60

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Pump Cutoff - High-High Level“ (Function 60) is closed, the High Level Alarm will be activated, pump operation will be disabled and Fault Code 1042 will be generated.

This feature will only operate in the Pump Up Mode (Parameter P.149 = 2).

Pump operation will not be re-enabled until the High-High Level input opens and the Pump Re-enable Delay - Pump Cutoff High-High Level (Parameter P.154) expires.

If an Output Relay (ROX1 - ROX12) is assigned Function 8, then the Output Relay’s contacts will be closed.

The status of the High Level Alarm may be read from Modbus Coil 48 (Register 40003 Bit 15).

The status of the “Pump Cutoff Active High-High Level” may be read from Modbus Coil 132 (Register 40009 Bit 3).

A Discrete Input assigned Function 60 is typically connected to a Float Switch that closes upon a High-High Level condition.

DISCRETE INPUT FUNCTIONS

Low Level Alarm Only - Function 61

When a Discrete Input assigned the Function of “Low Level Alarm Only“ (Function 61) is closed, the Low Level Alarm will be activated but pump operation will not be disabled. Also see Function 59.

If an Output Relay (ROX1 - ROX12) is assigned Function 7 then the Output Relay’s contacts will be closed.

The status of the Low Level Alarm may be read from Modbus Coil 47 (Register 40003 Bit 14).

A Discrete Input assigned Function 61 is typically connected to a Float Switch that closes upon a Low Level condition.

High Level Alarm Only - Function 62

When a Discrete Input assigned the Function of “High Level Alarm Only“ (Function 62) is closed, the High Level Alarm will be activated. Also see Function 60.

If an Output Relay (ROX1 - ROX12) is assigned Function 8, then the Output Relay’s contacts will be closed.

The status of the High Level Alarm may be read from Modbus Coil 48 (Register 40003 Bit 15).

A Discrete Input assigned Function 62 is typically connected to a Float Switch that closes upon a High Level condition.

Float Control - Off Level - Function 63

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - Off Level“ (Function 63) closes, the Float Control logic will arm itself and be ready to latch in one pump call for each of the “Float Control - 1st , 2nd, 3rd, 4th, 5th, 6th On Level“ inputs that close.

As the “Float Control - 1st , 2nd, 3rd, 4th, 5th, 6th On Level“ inputs open, the pump calls remain latched until the Off Level input also opens, then the latch is broken on all the pump calls, and the pumps are turned off.

A Discrete Input assigned Function 63 is typically connected to a Float Switch that closes as the liquid level arrives at the Off Level.

For Float Control and Float Backup examples see Section 1.

Float Control - 1ST On Level - Function 64

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - 1ST On Level“ (Function 64) closes, the Float Control logic will issue one pump call.

A Discrete Input assigned Function 64 is typically connected to a Float Switch that closes as the liquid level arrives at the 1ST On Level.

For Float Control and Float Backup examples see Section 1.

Float Control - 2ND On Level - Function 65

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - 2ND On Level“ (Function 65) closes, the Float Control logic will issue one pump call.

A Discrete Input assigned Function 65 is typically connected to a Float Switch that closes as the liquid level arrives at the 2ND On Level.

For Float Control and Float Backup examples see Section 1.

Float Control - 3RD On Level - Function 66

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - 3RD On Level“ (Function 66) closes, the Float Control logic will issue one pump call.

A Discrete Input assigned Function 66 is typically connected to a Float Switch that closes as the liquid level arrives at the 3RD On Level.

For Float Control and Float Backup examples see Section 1.

Float Control - 4TH On Level - Function 67

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - 4TH On Level“ (Function 67) closes, the Float Control logic will issue one pump call.

A Discrete Input assigned Function 67 is typically connected to a Float Switch that closes as the liquid level arrives at the 4TH On Level.

For Float Control and Float Backup examples see Section 1.

DISCRETE INPUT FUNCTIONS

Float Control - 5TH On Level - Function 68

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - 5TH On Level“ (Function 68) closes, the Float Control logic will issue one pump call.

A Discrete Input assigned Function 68 is typically connected to a Float Switch that closes as the liquid level arrives at the 5TH On Level.

For Float Control and Float Backup examples see Section 1.

Float Control - 6TH On Level - Function 69

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - 6TH On Level“ (Function 69) closes, the Float Control logic will issue one pump call.

A Discrete Input assigned Function 69 is typically connected to a Float Switch that closes as the liquid level arrives at the 6TH On Level.

For Float Control and Float Backup examples see Section 1.

Float Control - High Level (Pump Down Mode) - Function 70

In the Level Control Mode only (Parameter P.091 = 1), when a Discrete Input assigned the Function of “Float Control - High Level (Pump Down Mode)” (Function 70) is closed, the High Level Alarm will be activated.

Function 70 may only be used in the “Pump Down Mode”, not when in the “Pump Up Mode”.

If the “Float Control - Off Level“ (Function 63) input is closed, closure of the “Float Control - High Level” (Function 70) will cause the Float Control logic to issue a pump call to run for all available pumps, with a Lag Pump Delay between each pump call.

To form a two float backup system, the “Float Backup - 1st , 2nd, 3rd, 4th, 5th, 6th On Level“ inputs may be replaced with the High Level input assigned Function 70. The two float backup system also requires the use of a “Float Control - Off Level“ (Function 63).

If an Output Relay (ROX1 - ROX12) is assigned Function 8, then the Output Relay’s contacts will be closed.

The status of the High Level Alarm may be read from Modbus Coil 48 (Register 40003 Bit 15).

A Discrete Input assigned Function 70 is typically connected to a Float Switch that closes upon a High Level condition.

For Float Control example see Section 1.

DISCRETE INPUT SETUP

User / Operator Info.			SCADA	Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	

Discrete Input Setup

Setup				Discrete Input
F.101	1		40601	Discrete Input - D1
F.102	2		40602	Discrete Input - D2
F.103	3		40603	Discrete Input - D3
F.104	4		40604	Discrete Input - D4
F.105	5		40605	Discrete Input - D5
F.106	6		40606	Discrete Input - D6
F.107	7		40607	Discrete Input - D7
F.108	8		40608	Discrete Input - D8
F.109	9		40609	Discrete Input - D9
F.110	10		40610	Discrete Input - D10
F.111	11		40611	Discrete Input - D11
F.112	12		40612	Discrete Input - D12
F.113	13		40613	Discrete Input - D13
F.114	14		40614	Discrete Input - D14
F.115	15		40615	Discrete Input - D15
F.116	16		40616	Discrete Input - D16
F.117	17		40617	Discrete Input - D17
F.118	18		40618	Discrete Input - D18
F.119	19		40619	Discrete Input - D19
F.120	20		40620	Discrete Input - D20
F.121	61		40621	Discrete Input - D21
F.122	62		40622	Discrete Input - D22
F.123	63		40623	Discrete Input - D23
F.124	64		40624	Discrete Input - D24
F.125	65		40625	Discrete Input - D25
F.126	66		40626	Discrete Input - D26
F.127	67		40627	Discrete Input - D27
F.128	68		40628	Discrete Input - D28
F.129	69		40629	Discrete Input - D29
F.130	70		40630	Discrete Input - D30

Function of Input: **Connect To:**

0 = Collect Discrete Data for SCADA ..... Telemetry Contact

1 = Level Probe Electrode 1 ..... Level Probe
2 = Level Probe Electrode 2 ..... Level Probe
3 = Level Probe Electrode 3 ..... Level Probe
4 = Level Probe Electrode 4 ..... Level Probe
5 = Level Probe Electrode 5 ..... Level Probe
6 = Level Probe Electrode 6 ..... Level Probe
7 = Level Probe Electrode 7 ..... Level Probe
8 = Level Probe Electrode 8 ..... Level Probe
9 = Level Probe Electrode 9 ..... Level Probe
10 = Level Probe Electrode 10 ..... Level Probe

11 = Pump 1 Disable ..... HOA and Fault Logic
12 = Pump 2 Disable ..... HOA and Fault Logic
13 = Pump 3 Disable ..... HOA and Fault Logic
14 = Pump 4 Disable ..... HOA and Fault Logic
15 = Pump 5 Disable ..... HOA and Fault Logic
16 = Pump 6 Disable ..... HOA and Fault Logic

17 = All Pump Disable ..... Phase Monitor
18 = On Generator ..... Automatic Transfer Switch
19 = Switch Between ALM1 & ALM2 for Level Input .... Select Switch
20 = Start Flush Cycle ..... External Time Clock

21 = External Alternation - Group 1 ..... External Time Clock
22 = External Alternation - Group 2 ..... External Time Clock

31 = Sequence Input 1 ..... Lead Select Switch - 1 as Lead
32 = Sequence Input 2 ..... Lead Select Switch - 2 as Lead
33 = Sequence Input 3 ..... Lead Select Switch - 3 as Lead
34 = Sequence Input 4 ..... Lead Select Switch - 4 as Lead
35 = Sequence Input 5 ..... Lead Select Switch - 5 as Lead
36 = Sequence Input 6 ..... Lead Select Switch - 6 as Lead

41 = Call Pump 1 Last ..... Logic Contact
42 = Call Pump 2 Last ..... Logic Contact
43 = Call Pump 3 Last ..... Logic Contact
44 = Call Pump 4 Last ..... Logic Contact
45 = Call Pump 5 Last ..... Logic Contact
46 = Call Pump 6 Last ..... Logic Contact

47 = Flow Calculator - Start New Day ..... External Time Clock

Pump Cutoff & Alarm

59 = Pump Cutoff - Low-Low Level (Pump Down Mode).... Float Switch
60 = Pump Cutoff - High-High Level (Pump Up Mode) ..... Float Switch

Alarm Only

61 = Low Level Alarm Only ..... Float Switch
62 = High Level Alarm Only ..... Float Switch

Pump Control & Alarm

63 = Float Control – Off Level ..... Float Switch
64 = Float Control – 1ST On Level ..... Float Switch
65 = Float Control – 2ND On Level ..... Float Switch
66 = Float Control – 3RD On Level ..... Float Switch
67 = Float Control – 4TH On Level ..... Float Switch
68 = Float Control – 5TH On Level ..... Float Switch
69 = Float Control – 6TH On Level ..... Float Switch
70 = Float Control – High Level (Pump Down Mode).....Float Switch

Notes:

1. Any Discrete Input may be set for Function “0” when the input is used only to collect data for SCADA and no other Function is desired.
2. The status of the Discrete Inputs may be read as a “0” or “1” from Modbus Coils 1 - 30 (Register 40001 Bits 0 - 15 and Register 40002 Bits 0 - 13). See page A-10.
3. For a description of the Functions see pages A-2 - A-6.
4. Pump 1(2,3,4,5,6) Disable logic may be inverted using Parameter F.145. See page A-8.

DISCRETE INPUT SETUP

User / Operator Info.			SCADA	
Parameter	Default Value	Current Value	Register Address	Description of Parameters
Discrete Input Setup				
F.141	100		40641	Discrete Input Sensitivity - D1 - D10 Range: 90 - 210 100 = Standard Sensitivity 150 = Extra Sensitive
F.142	100		40642	Discrete Input Sensitivity - D11 - D20 Range: 90 - 210 100 = Standard Sensitivity 150 = Extra Sensitive
F.143	100		40643	Discrete Input Sensitivity - D21 - D30 Range: 90 - 210 100 = Standard Sensitivity 150 = Extra Sensitive
Pump Disable Setup				
F.145	0		40645	Discrete Input Pump Disable Mode 0 = Disable Pump with Closed Discrete Input 1 = Disable Pump with Open Discrete Input Note: This parameter only applies to Discrete Inputs that are assigned to be Pump Disable Inputs (Function 11 - 16).

DISCRETE INPUT STATUS

User / Operator Info. Parameter	SCADA Register Address	Description of Parameters and SCADA Notes
Discrete Input Analog Test Signal Status		
A.101	41801	Discrete Input - D1
A.102	41802	Discrete Input - D2
A.103	41803	Discrete Input - D3
A.104	41804	Discrete Input - D4
A.105	41805	Discrete Input - D5
A.106	41806	Discrete Input - D6
A.107	41807	Discrete Input - D7
A.108	41808	Discrete Input - D8
A.109	41809	Discrete Input - D9
A.110	41810	Discrete Input - D10
A.111	41811	Discrete Input - D11
A.112	41812	Discrete Input - D12
A.113	41813	Discrete Input - D13
A.114	41814	Discrete Input - D14
A.115	41815	Discrete Input - D15
A.116	41816	Discrete Input - D16
A.117	41817	Discrete Input - D17
A.118	41818	Discrete Input - D18
A.119	41819	Discrete Input - D19
A.120	41820	Discrete Input - D20
A.121	41821	Discrete Input - D21
A.122	41822	Discrete Input - D22
A.123	41823	Discrete Input - D23
A.124	41824	Discrete Input - D24
A.125	41825	Discrete Input - D25
A.126	41826	Discrete Input - D26
A.127	41827	Discrete Input - D27
A.128	41828	Discrete Input - D28
A.129	41829	Discrete Input - D29
A.130	41830	Discrete Input - D30

Notes:

1. Each of the Discrete Inputs send out a low voltage (+/- 6 V), low current (0.6 mA), AC (60 Hz) square wave as a Test Signal to determine the status of the input, either Open or Closed. The Status of the Test Signals for each of the Discrete Input (as an analog value) may be viewed from Parameters A.101 - A.130.
2. The Controller compares each of the Test Signal analog values with the Discrete Input Sensitivity set on Parameters F.141 - F.143. Each Discrete I/O Board, having 10 Discrete Inputs each, has its own Discrete Input Sensitivity setting (Parameters F.141 - F.143). See page A-8.

   The Discrete Input is considered to be:

   Open - When the Test Signal is above the Sensitivity setting.

   Closed - When the Test Signal is below the Sensitivity setting.
3. Each Discrete I/O Board generates its own 60 Hz square wave Clock Signal that is used to generate the Discrete Input Test Signals for its 10 inputs. The analog values of these Clocks are available to be viewed from Parameters A.141 - A.143. See below.
4. The status of all the Discrete Inputs as a discrete value may also be read from Modbus Coils 1 - 30 (Register 40001 Bits 0 - 15, & Register 40002 Bits 0 - 13). See page A-10.

Parameter	Register Address	Data Description
A.141	41841	Clock Signal for Discrete Inputs: D1 - D10
A.142	41842	Clock Signal for Discrete Inputs: D11 - D20
A.143	41843	Clock Signal for Discrete Inputs: D21 - D30

DISCRETE INPUT STATUS

SCADA Register Address	Description of Register Contents (Where a Modbus Coils are represented by a Bit in a Register)																
40001	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Coil
	D16 - Discrete Input Status	D15 - Discrete Input Status	D14 - Discrete Input Status	D13 - Discrete Input Status	D12 - Discrete Input Status	D11 - Discrete Input Status	D10 - Discrete Input Status	D9 - Discrete Input Status	D8 - Discrete Input Status	D7 - Discrete Input Status	D6 - Discrete Input Status	D5 - Discrete Input Status	D4 - Discrete Input Status	D3 - Discrete Input Status	D2 - Discrete Input Status	D1 - Discrete Input Status	
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit
40002	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Coil
	Spare	Spare	D30 - Discrete Input Status	D29 - Discrete Input Status	D28 - Discrete Input Status	D27 - Discrete Input Status	D26 - Discrete Input Status	D25 - Discrete Input Status	D24 - Discrete Input Status	D23 - Discrete Input Status	D22 - Discrete Input Status	D21 - Discrete Input Status	D20 - Discrete Input Status	D19 - Discrete Input Status	D18 - Discrete Input Status	D17 - Discrete Input Status	
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit

HMI Display of Discrete Input Discrete Status

SC5000-CTS-HMI

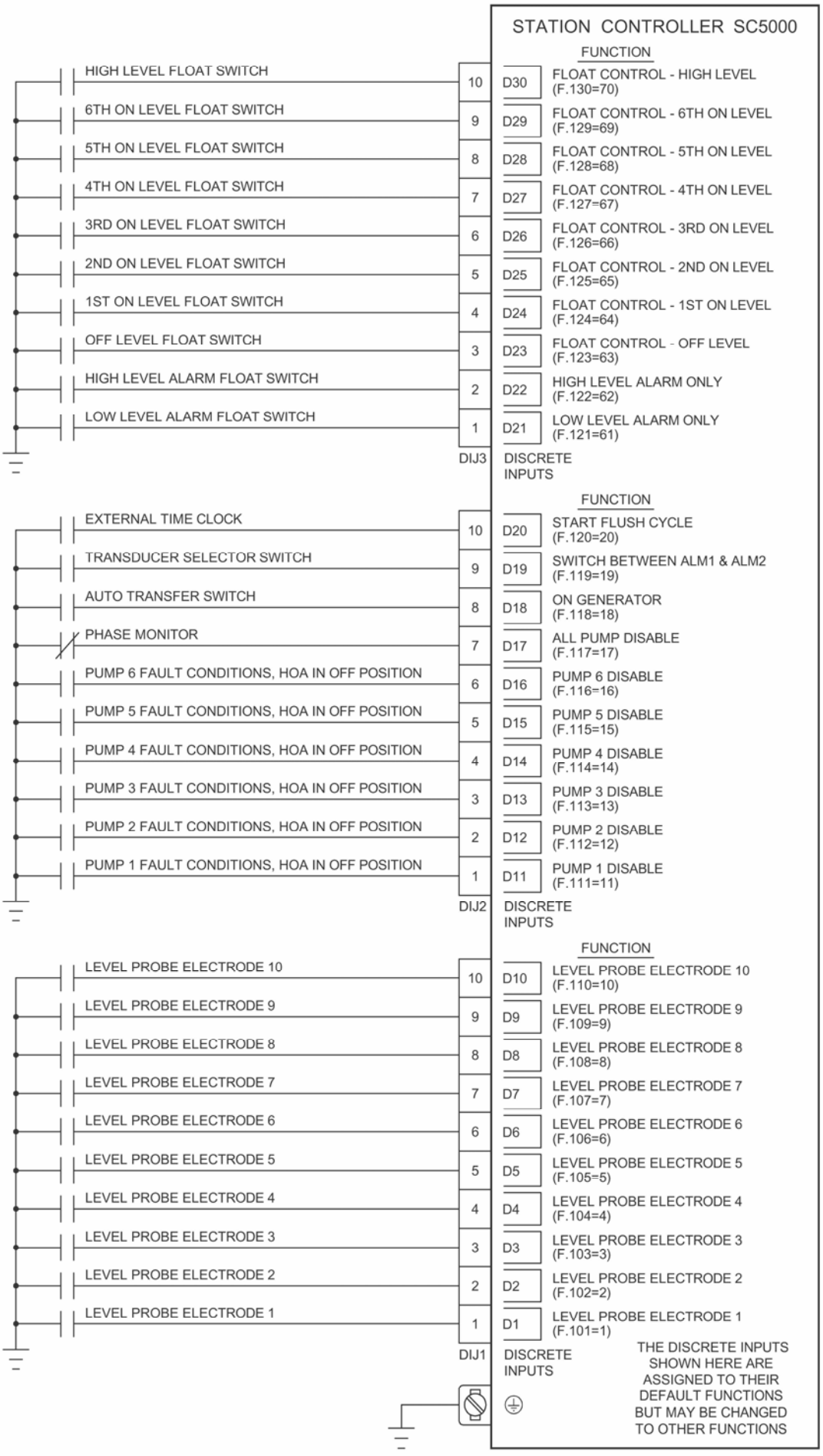
The **SC5000-CTS-HMI** shows the Discrete Status of the Discrete Inputs on the Discrete Input screens on the HMI. See pages A-14 - A-15.

SC5000-LED-HMI

The **SC5000-LED-HMI** shows the Discrete Status of the Discrete Inputs on Parameters n.01 - n.30 in the Menu. See page X-19.

DISCRETE INPUTS

Connection Diagram

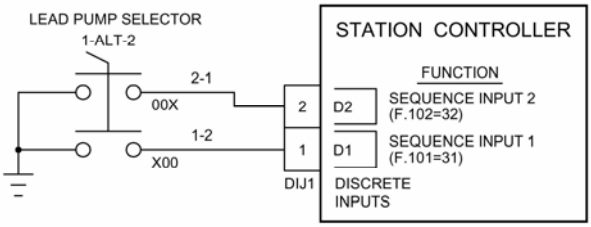


DISCRETE INPUT - LEAD PUMP SELECTOR SWITCH EXAMPLES

LEVEL CONTROL MODE - Parameter P.091 = 1

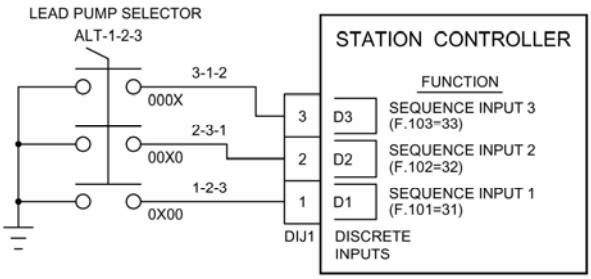
DUPLEX - STANDARD ALTERNATION

NUMBER OF PUMPS PRESENT: P.092 = 2
ALTERNATION SEQUENCE MODE: P.122 = 1



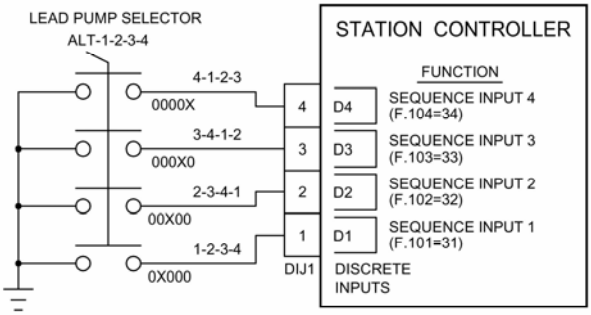
TRIPLEX - STANDARD ALTERNATION

NUMBER OF PUMPS PRESENT: P.092 = 3
ALTERNATION SEQUENCE MODE: P.122 = 1



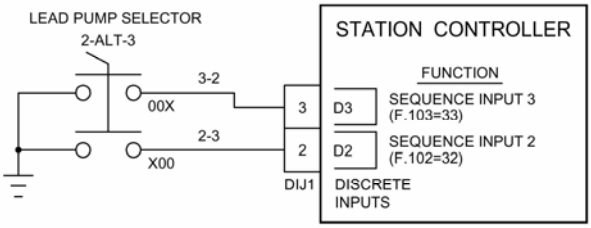
QUADRAPLEX - STANDARD ALTERNATION

NUMBER OF PUMPS PRESENT: P.092 = 4
ALTERNATION SEQUENCE MODE: P.122 = 1



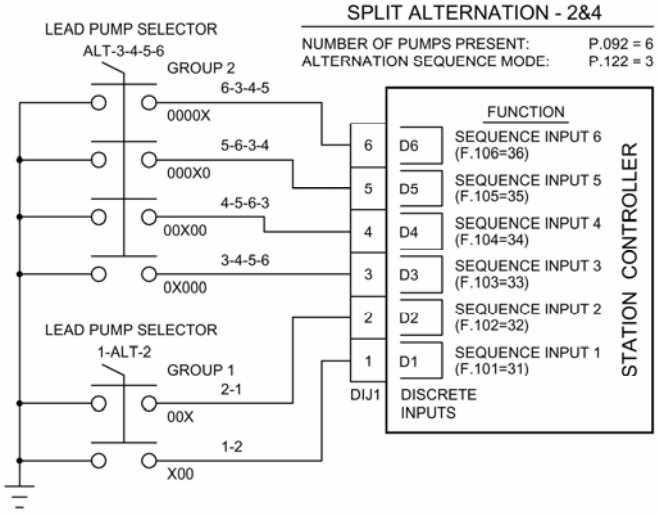
TRIPLEX - PUMP 1 ALWAYS LEAD

NUMBER OF PUMPS PRESENT: P.092 = 3
ALTERNATION SEQUENCE MODE: P.122 = 2



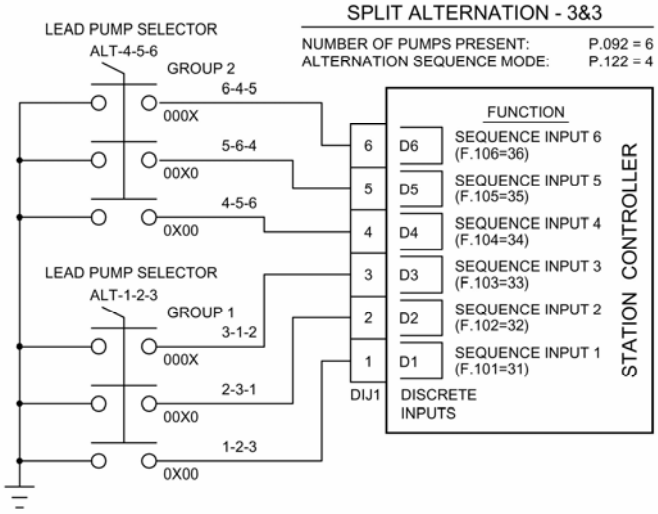
SPLIT ALTERNATION - 2&4

NUMBER OF PUMPS PRESENT: P.092 = 6
ALTERNATION SEQUENCE MODE: P.122 = 3



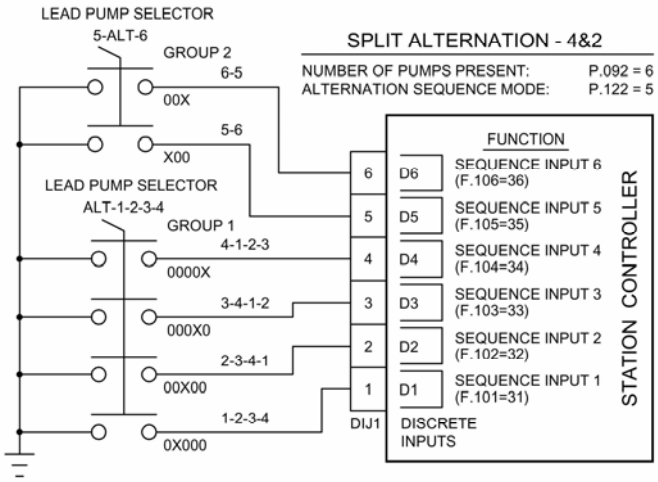
SPLIT ALTERNATION - 3&3

NUMBER OF PUMPS PRESENT: P.092 = 6
ALTERNATION SEQUENCE MODE: P.122 = 4



SPLIT ALTERNATION - 4&2

NUMBER OF PUMPS PRESENT: P.092 = 6
ALTERNATION SEQUENCE MODE: P.122 = 5



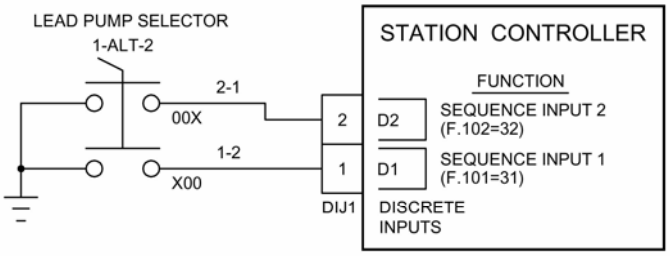
DISCRETE INPUT - LEAD PUMP SELECTOR SWITCH EXAMPLES

FLOW CONTROL MODE - Parameter P.091 = 2
PRESSURE CONTROL MODE - Parameter P.091 = 3
BOOSTER DISCHARGE PRESSURE CONTROL MODE - Parameter P.091 = 4 **
BOOSTER SUPPLY PRESSURE CONTROL MODE - Parameter P.091 = 5 **

** With Parameter P.122 = 1

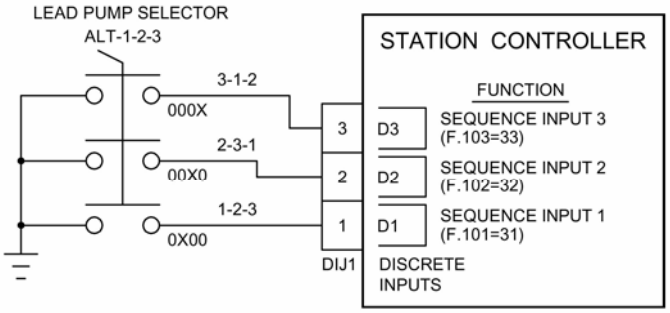
DUPLEX - STANDARD ALTERNATION

NUMBER OF PUMPS PRESENT: P.092 = 2
ALTERNATION SEQUENCE MODE: P.122 = 1



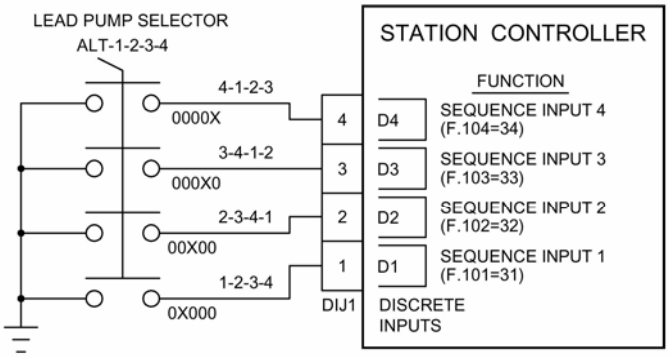
TRIPLEX - STANDARD ALTERNATION

NUMBER OF PUMPS PRESENT: P.092 = 3
ALTERNATION SEQUENCE MODE: P.122 = 1

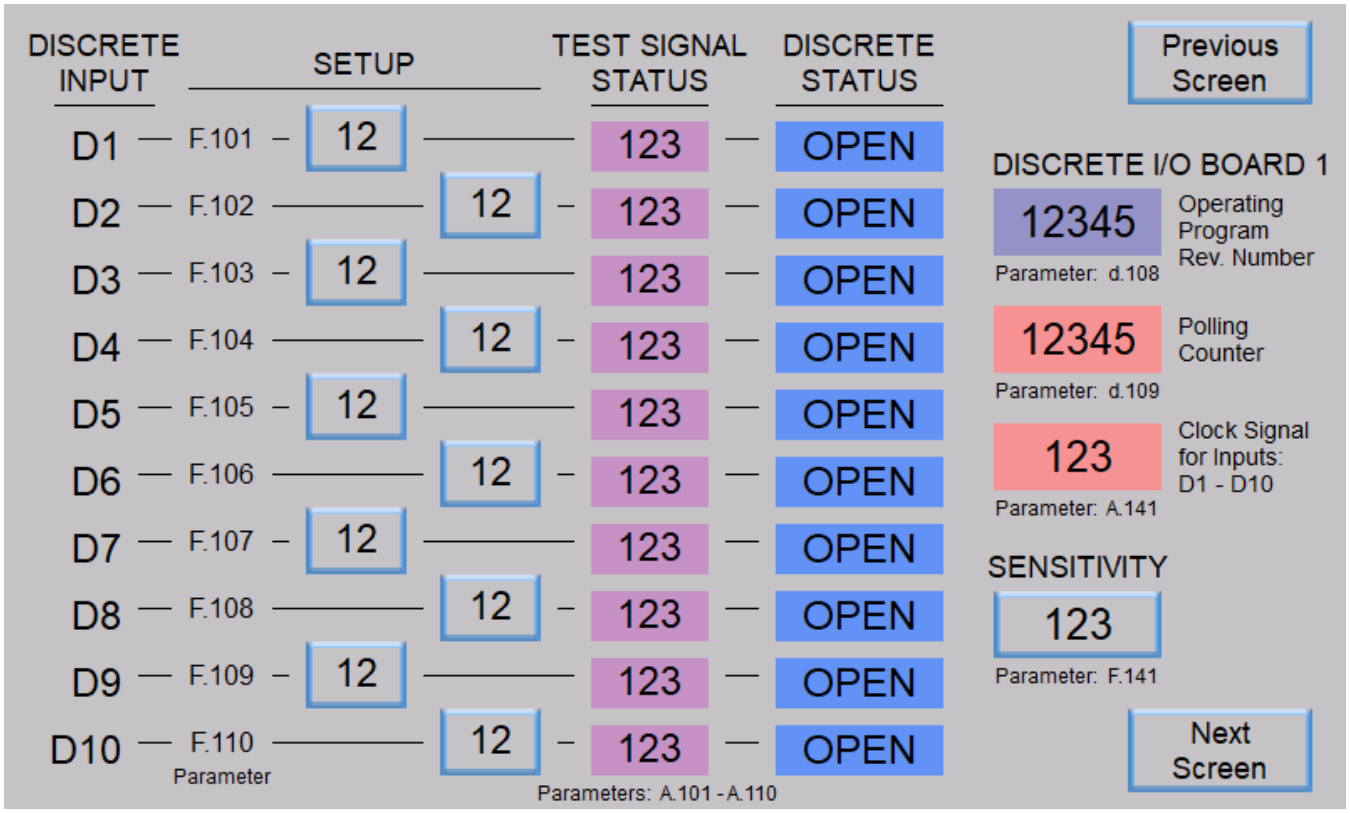


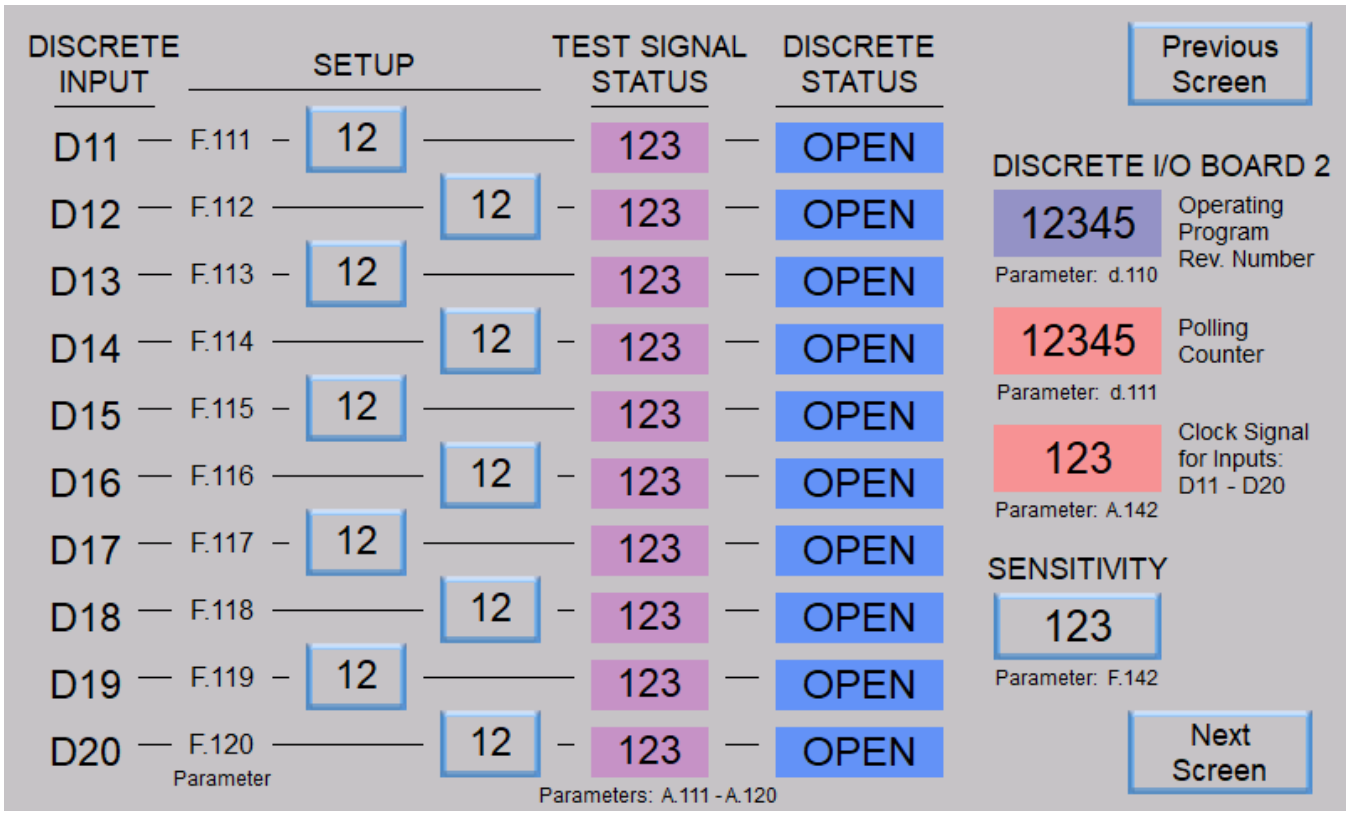
QUADRAPLEX - STANDARD ALTERNATION

NUMBER OF PUMPS PRESENT: P.092 = 4
ALTERNATION SEQUENCE MODE: P.122 = 1



DISCREET INPUTS - Touchscreen HMI SCREENS





DISCREET INPUTS - Touchscreen HMI SCREENS