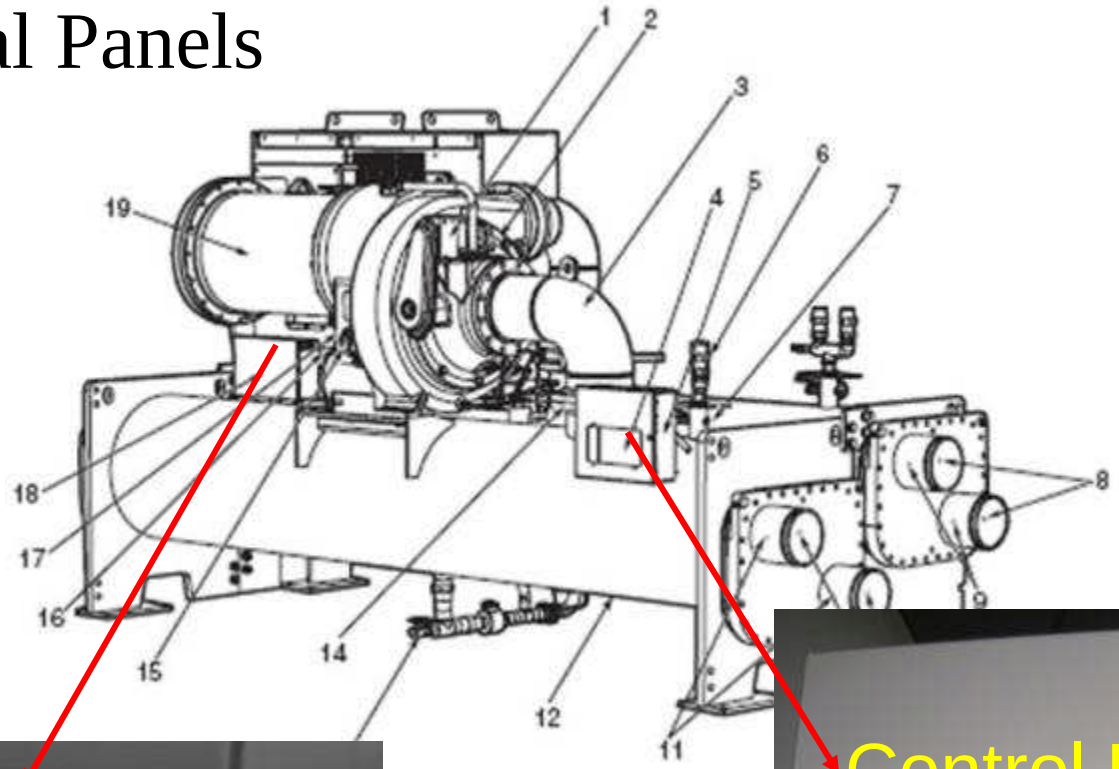
19XRV Controls

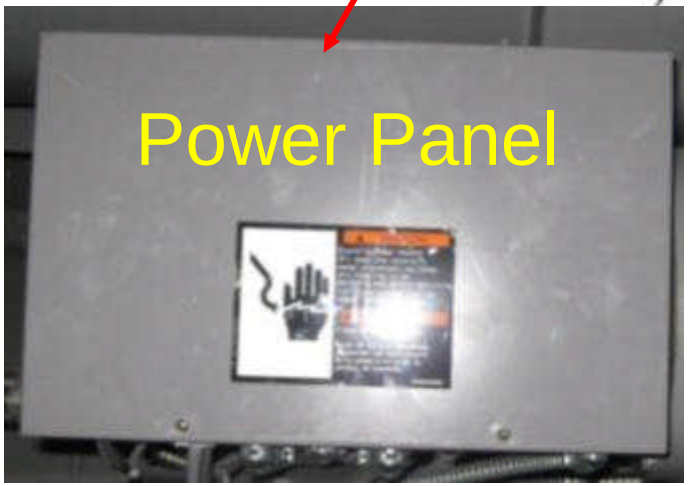
Chee Nee Bong

June 2012

19XRV

Electrical Panels





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ICVC

Carrier
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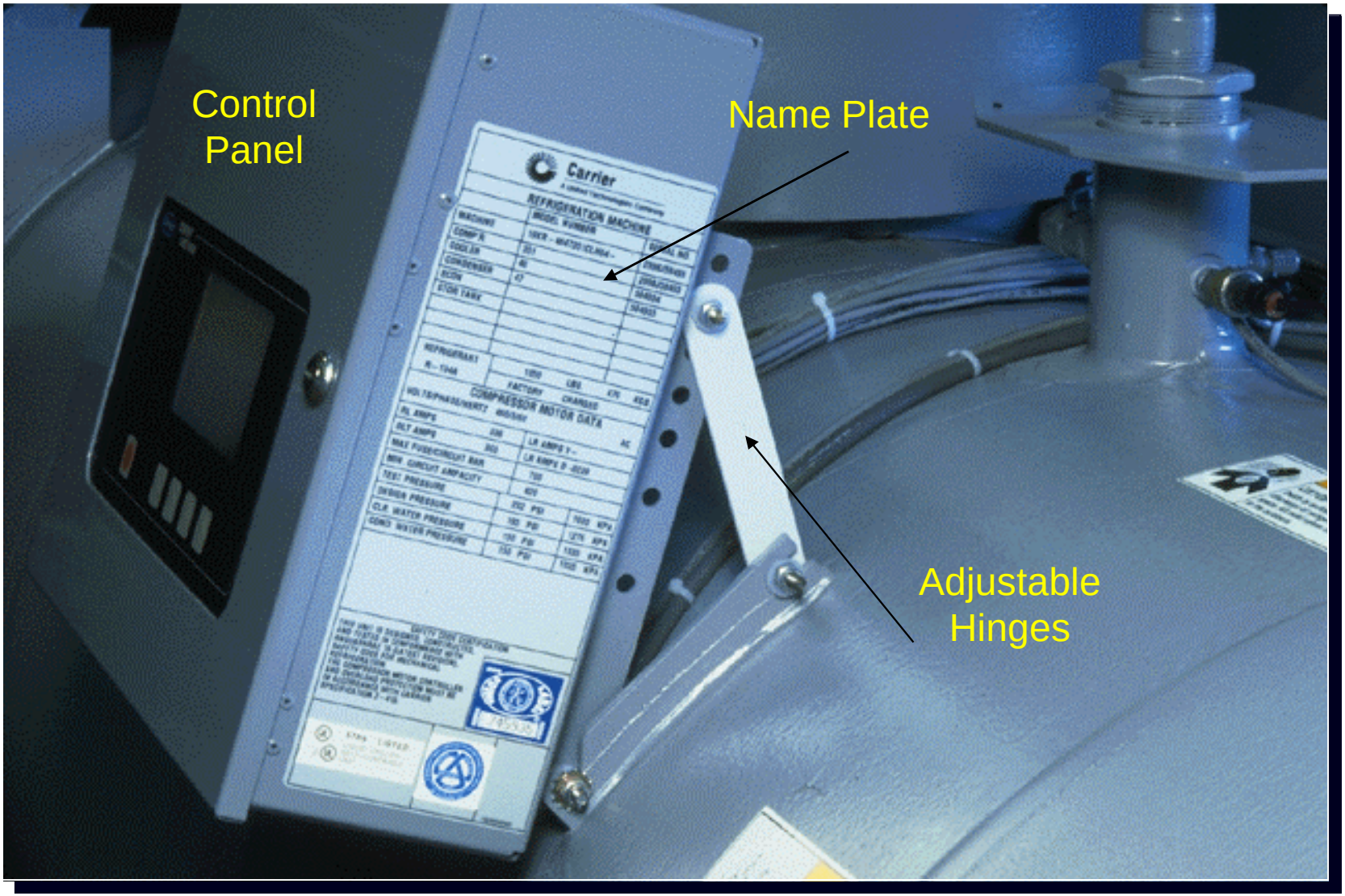
ICVC



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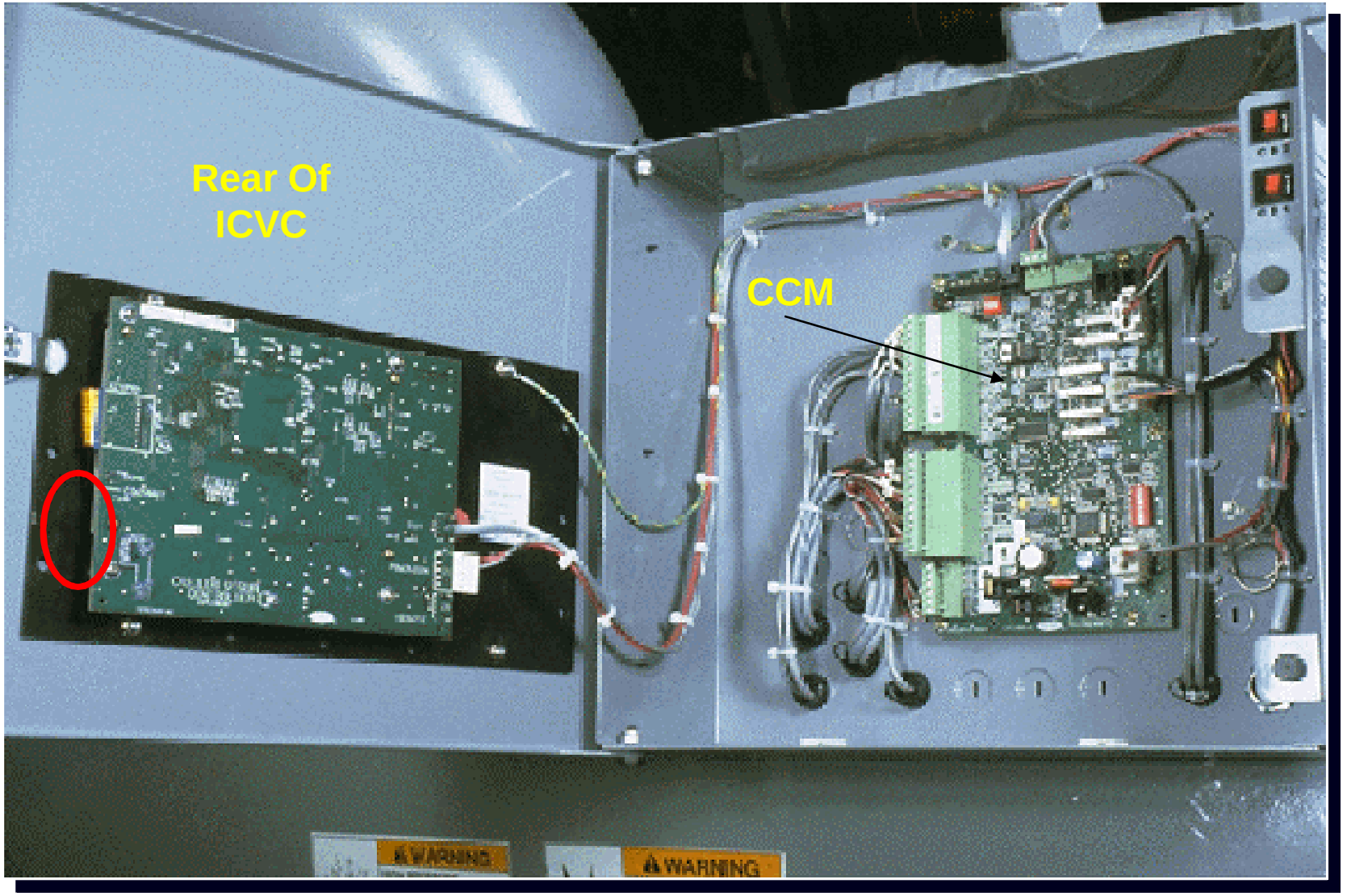

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Rear of ICVC

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Rear of ICVC

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Rear of ICVC

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2

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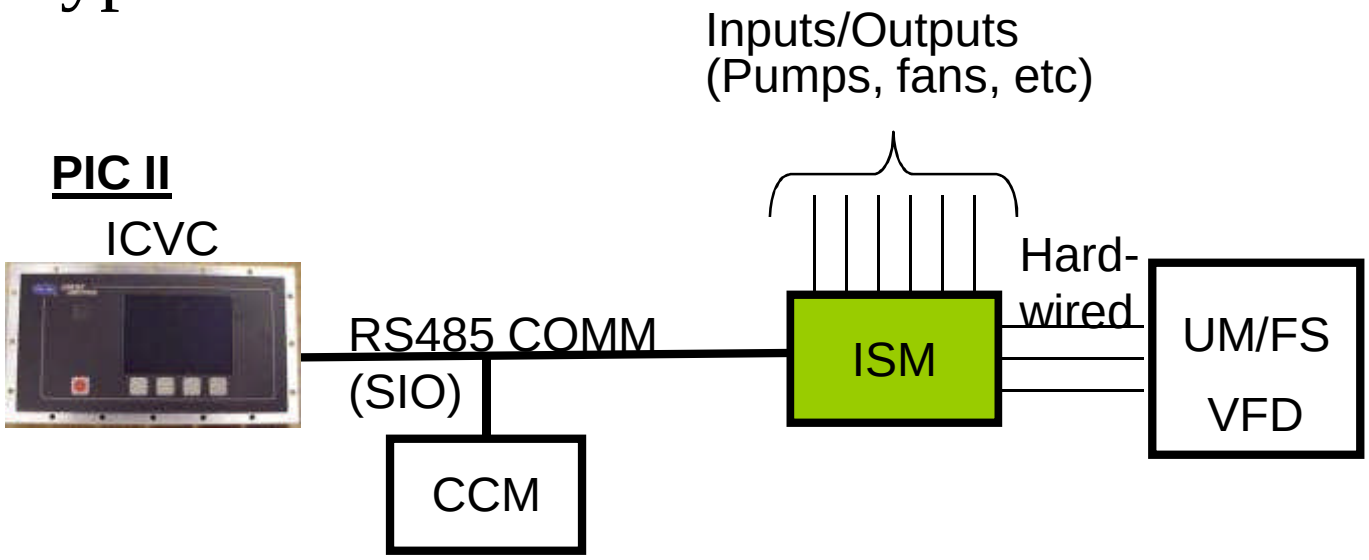
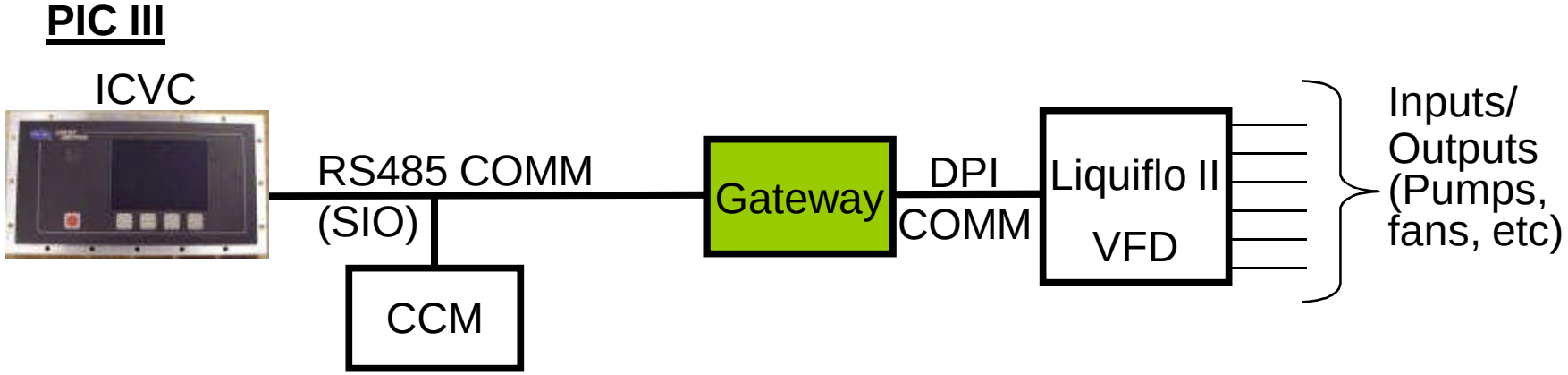
Types of Control





DPI -- Drive Peripheral Interface

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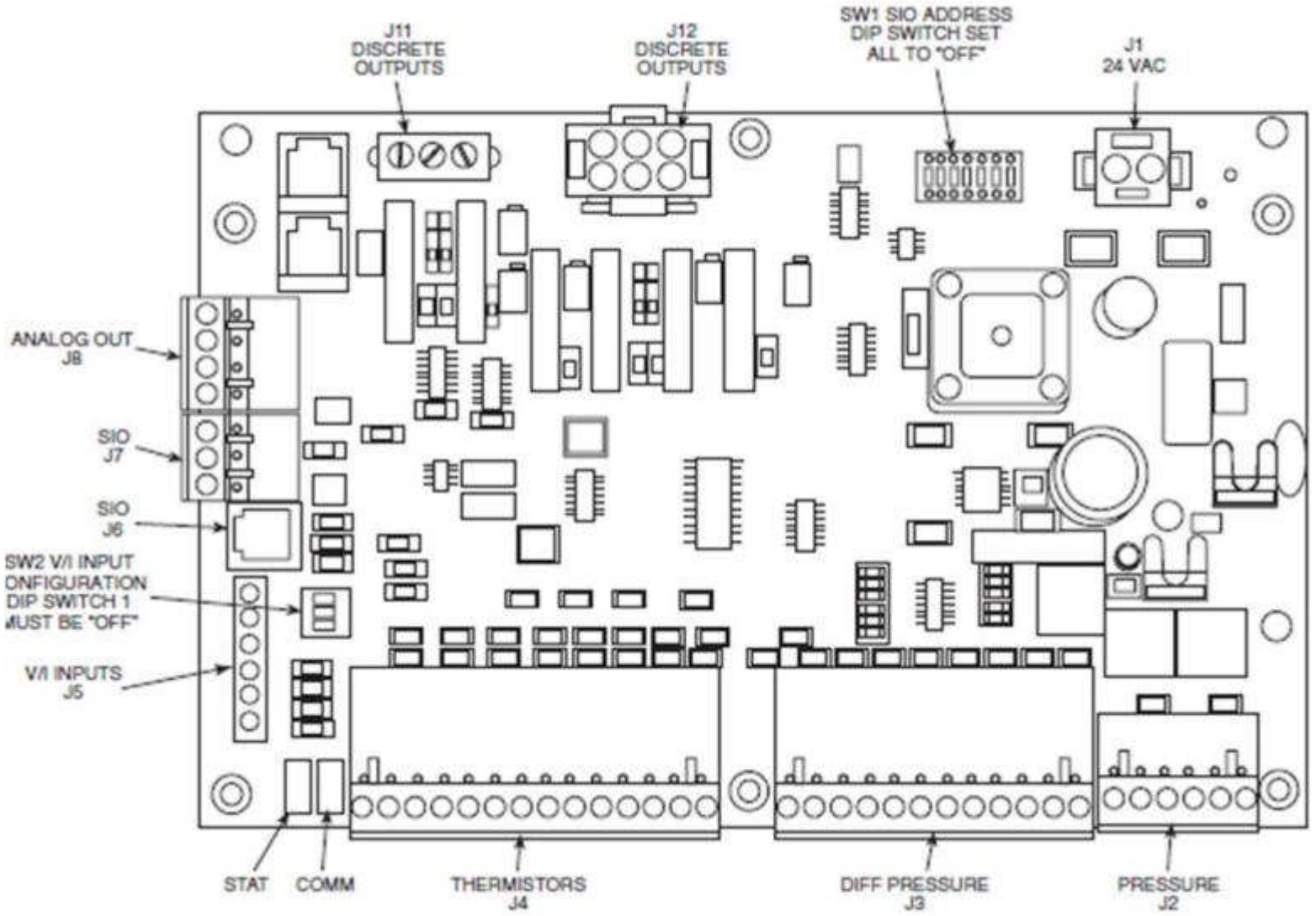

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CCM

Input

- Oil Sump
- Oil Discharge
- Diffuser Pressure
- Evap Leaving/Entering Water Temp
- Cond Leaving/Entering Water Temp
- Evap Refrigerant Pressure
- Cond Refrigerant Pressure

Output

- Diffuser Actuator
- Guide Vane Actuator
- Hot Gas Bypass
- Compressor Oil Heater

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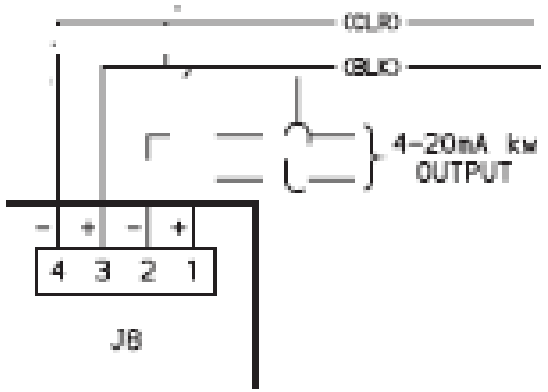
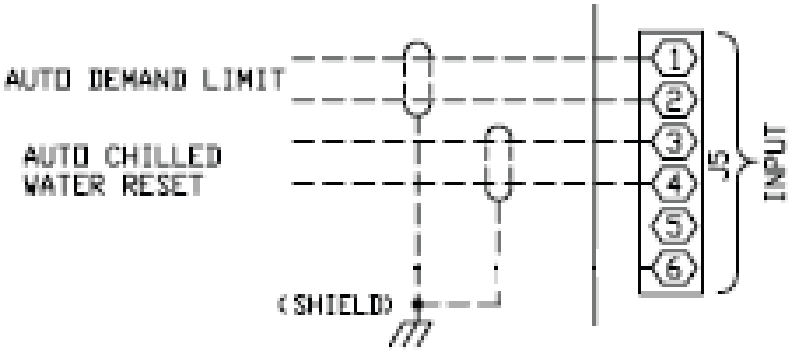
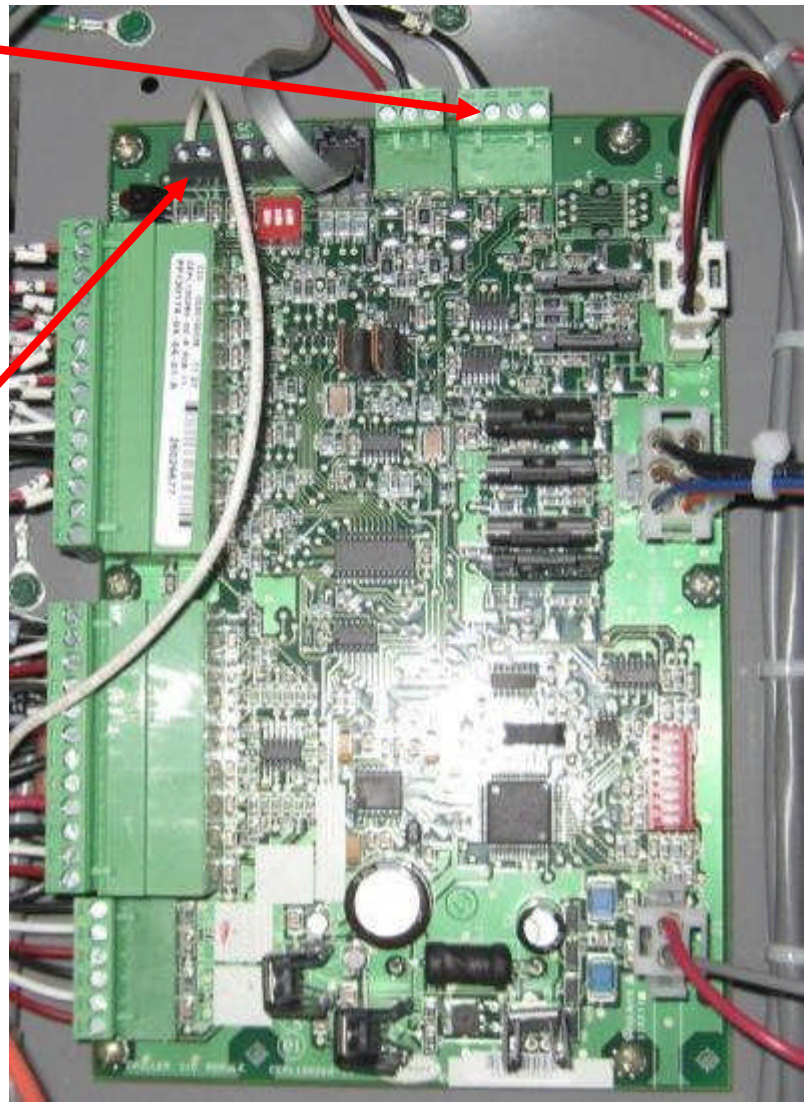
CCM

4-20ma KW Output



Chilled water reset/Demand Limit





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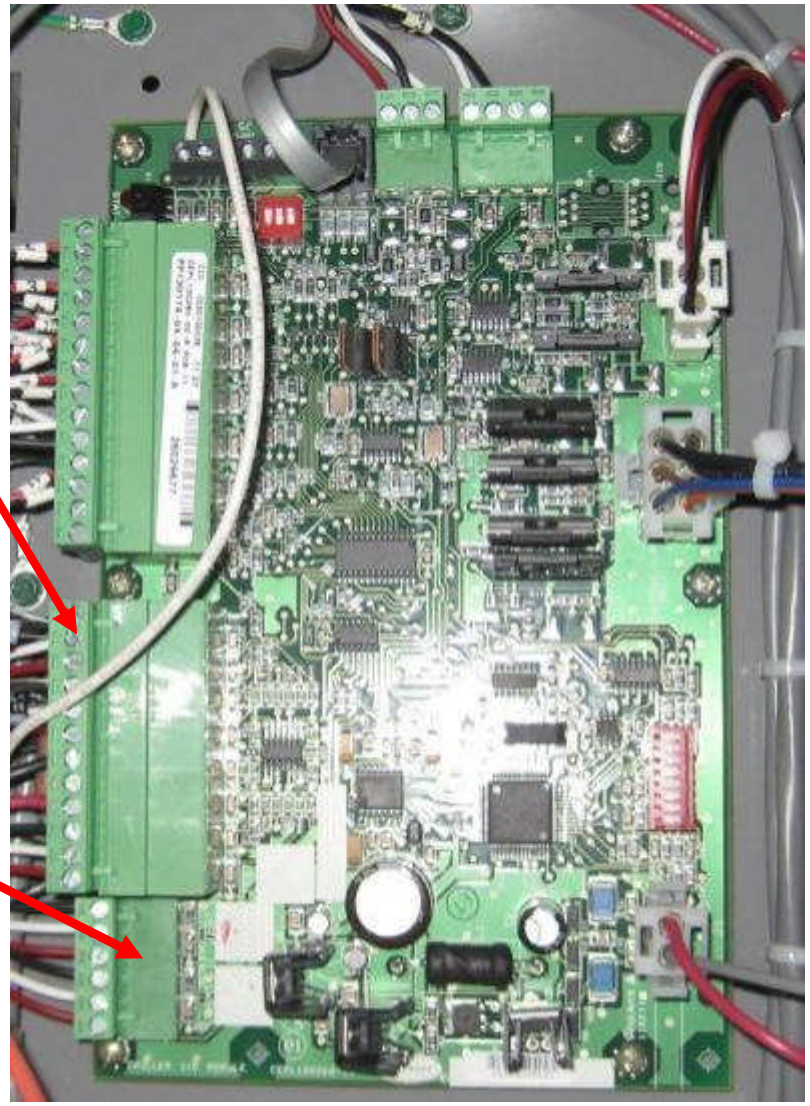
CCM Control

J3 Transducer Inputs

- Oil Sump
- Oil Pump Discharge
- Diffuser Pressure
- Evaporator Leaving Water
- Evaporator Entering Water
- Condenser Leaving Water
- Condenser Entering Water

J2 Transducer Inputs

- Evaporator Refrigerant Pressure
- Condenser Refrigerant Pressure



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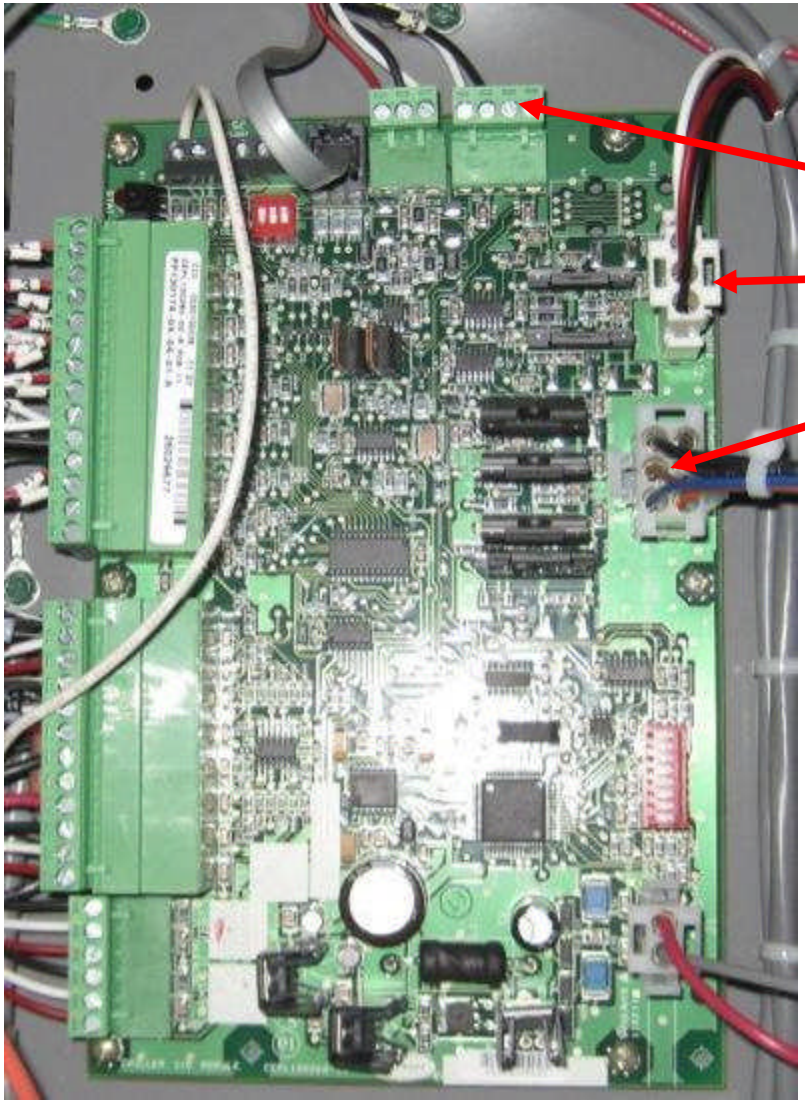
CCM Control

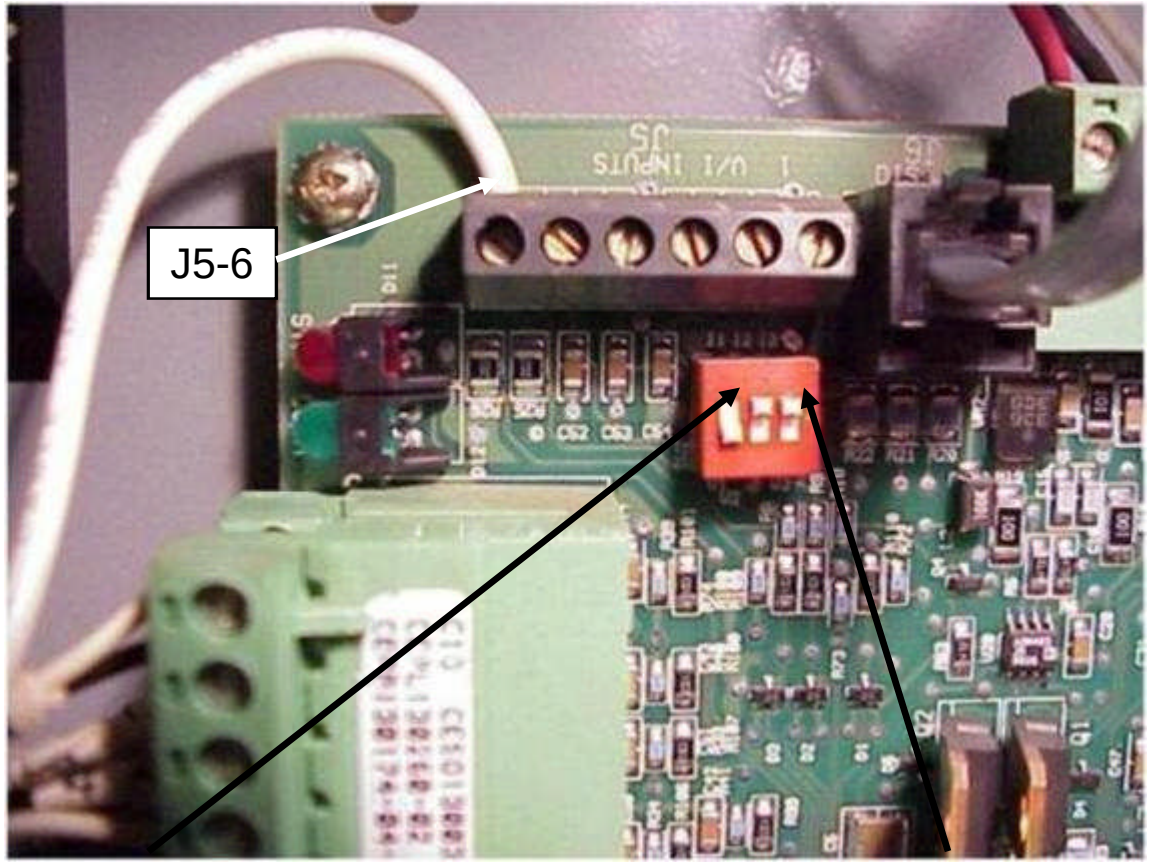


Outputs

Diffuser Actuator	– J8
Guide Vane Actuator	– J11
Hot Gas Bypass	– J12
Compressor Oil Heater	– J12

ROCKWELL PF755

CCM SW2 Switch



19XRV PIC 3 SW2 Switch 1 must be “OFF” for 0-5 V Humidity Sensor Input on Terminal J5-6

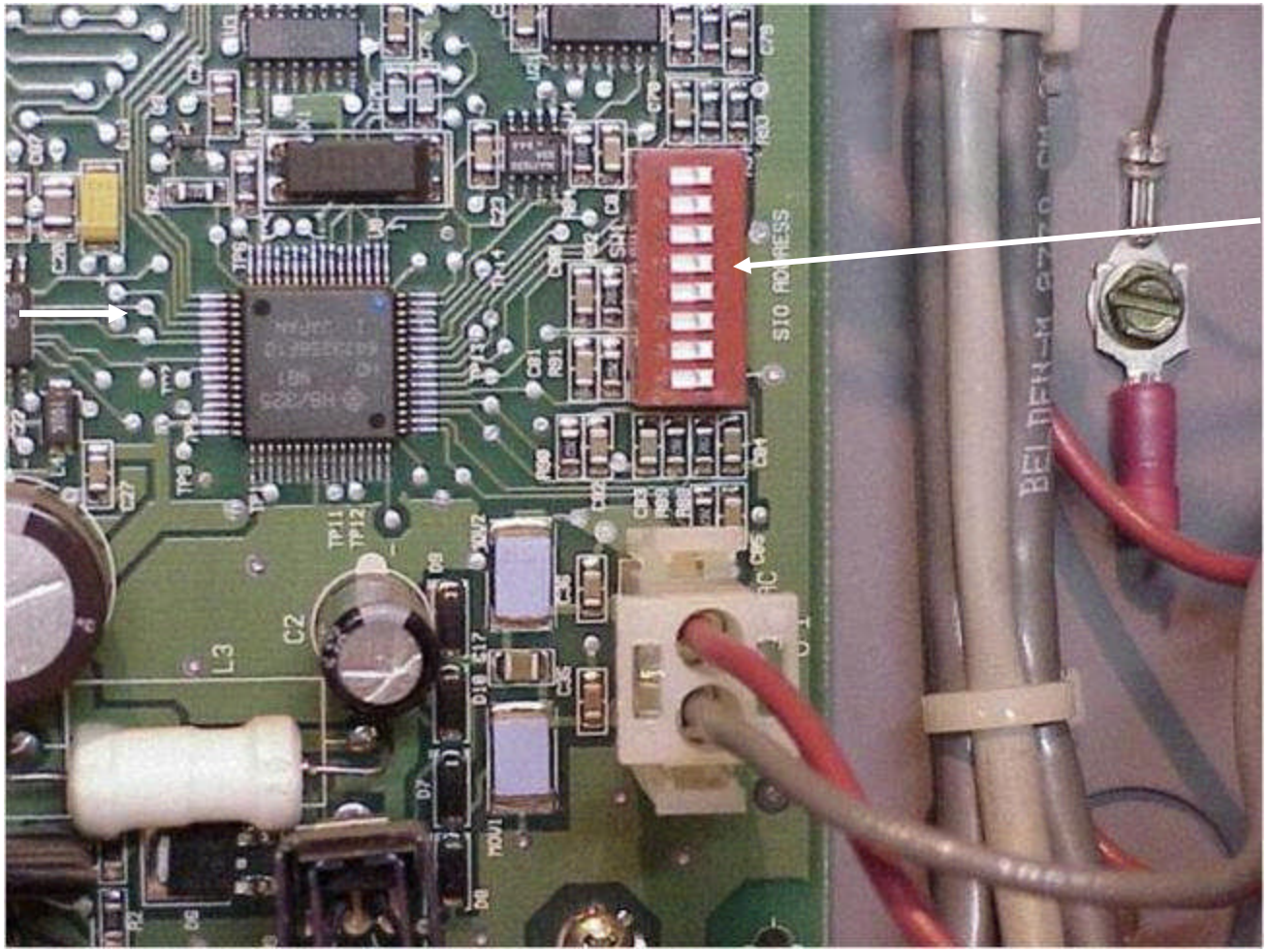
Switches 2 & 3 Set per Type of Optional J5 Input

“ON” Position (shown) for 4-20 mA Signal

“OFF” Position for 0 – 5 V Signal

ROCKWELL PF755

CCM SW1 Switch



SW1 SIO Address Switches all set to "OFF"

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Optional Flow Switch Wiring

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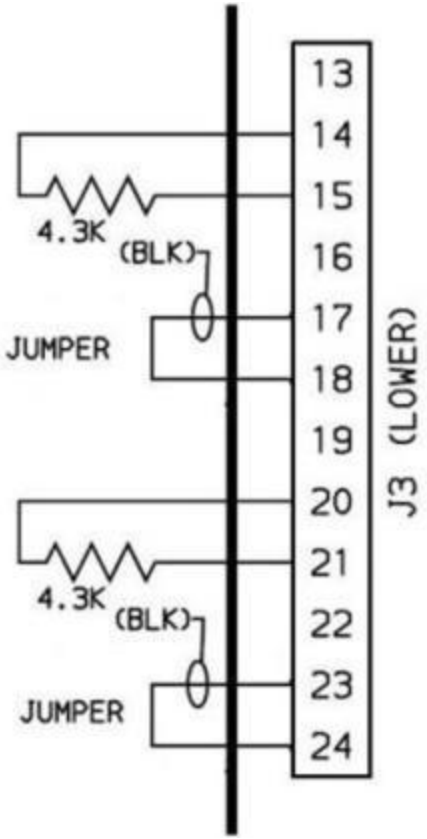
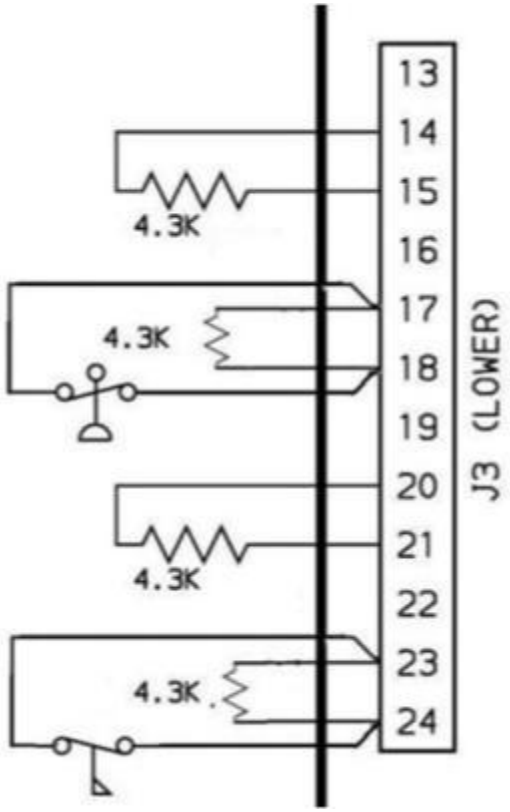
No Flow Switches



Optional Flow Switches



CCM

***These devices are not supported by* the chiller warranty**

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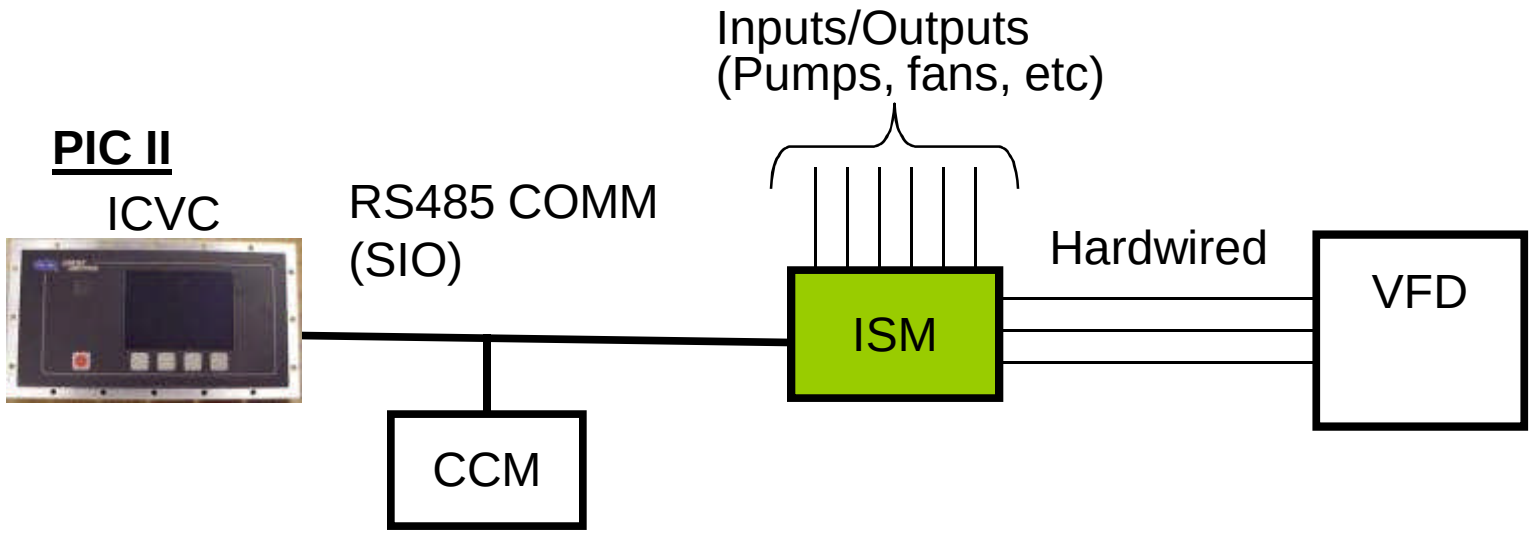
PIC II



PIC II Controls
Rockwell LF1, 4160V starter
Any starter that does not have capabilities to translate and communicate with ICVC directly will communicate via ISM board

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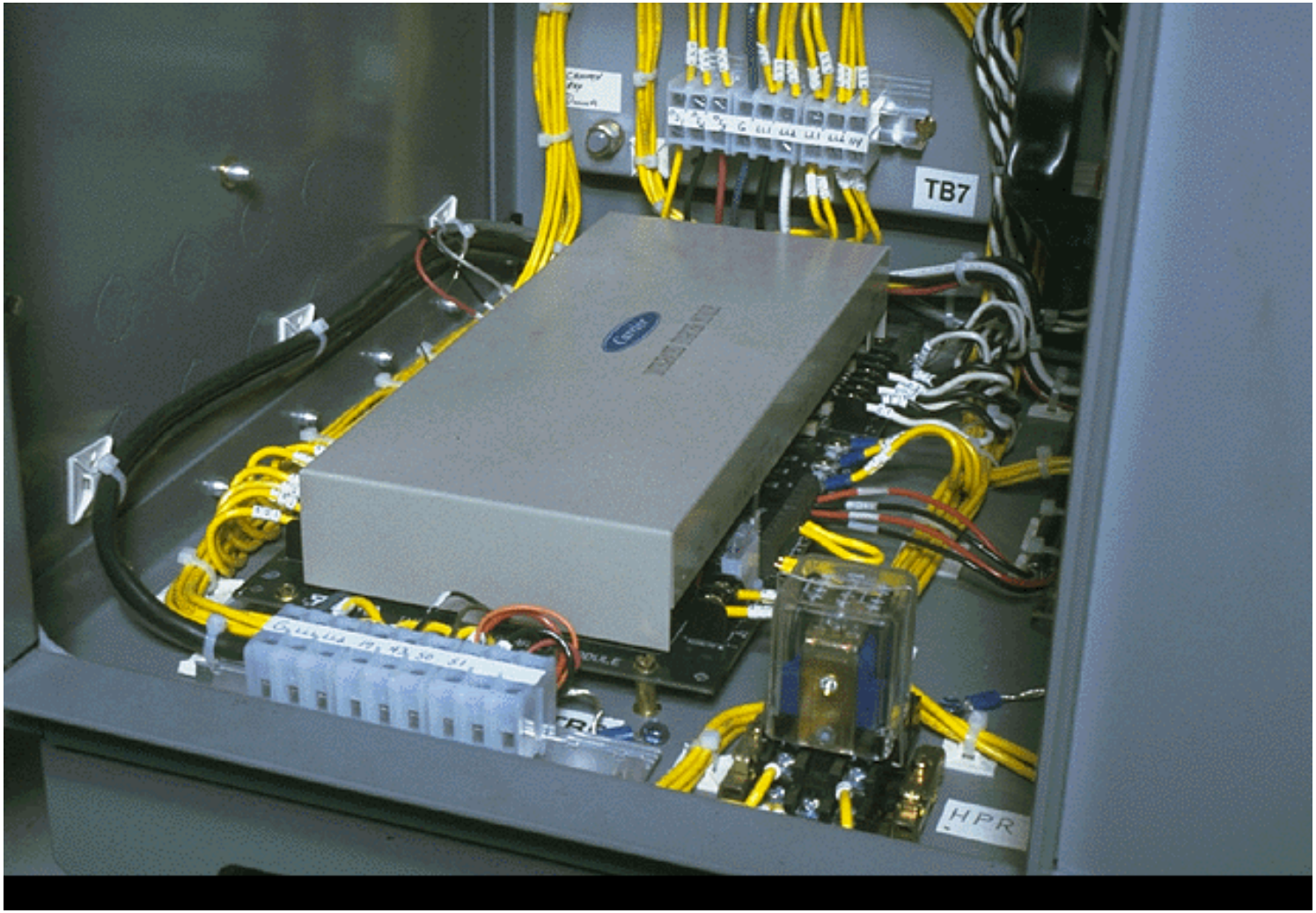
PIC II -- ISM Module



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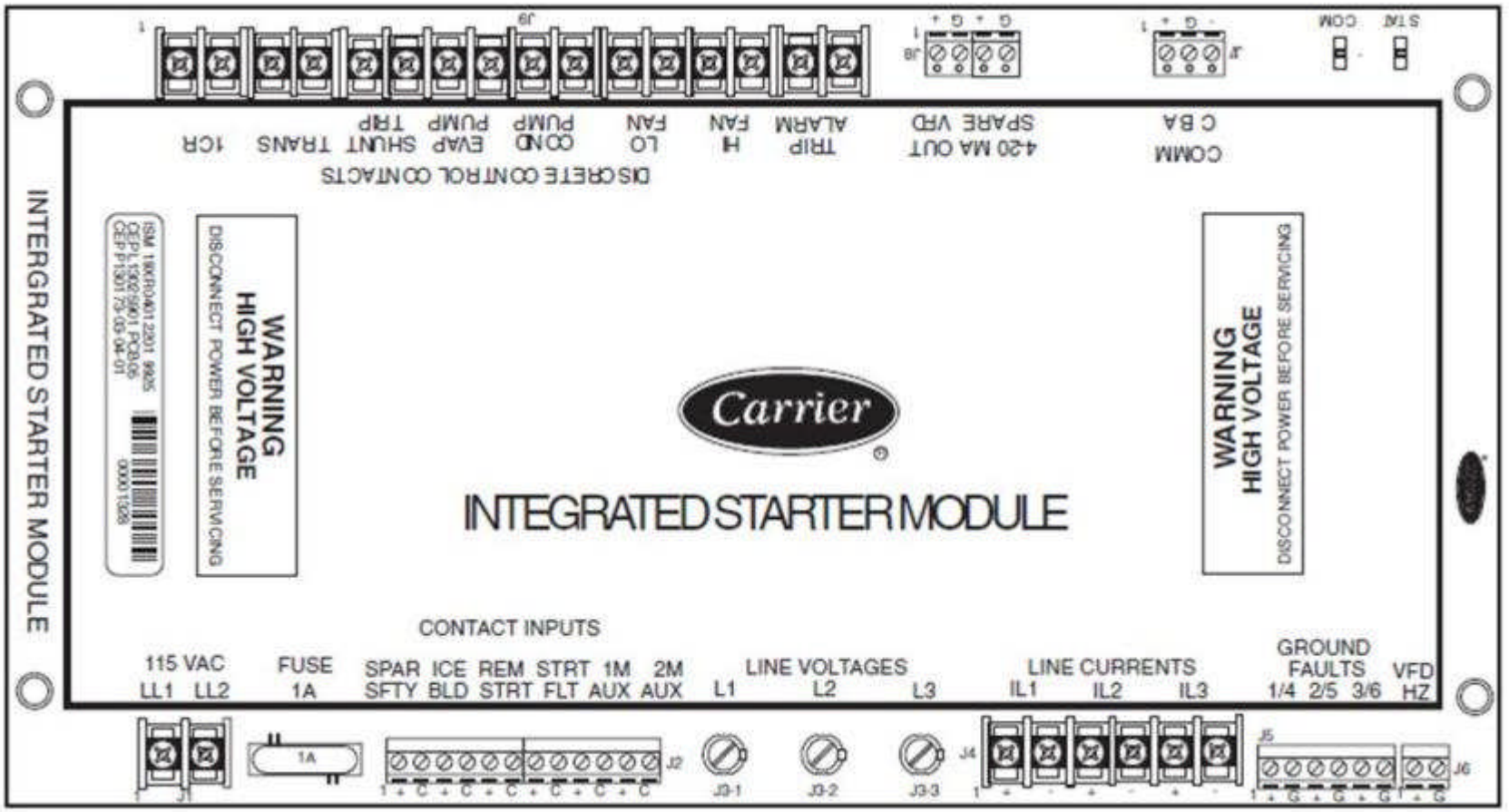
PIC II -- ISM Module



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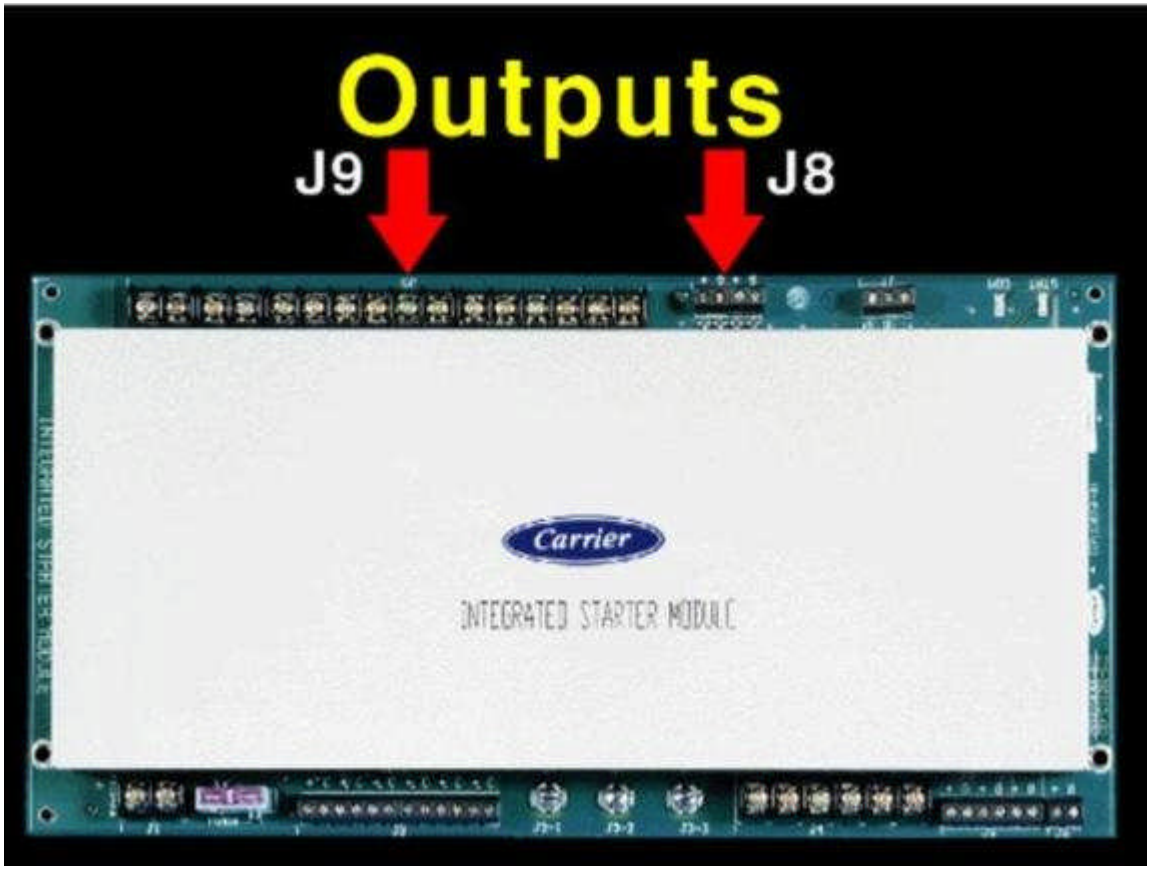
PIC II -- ISM Module



J8

1&2: 4-20ma output for VFD speed control

3&4: Spare of 4-20ma head pressure reference ouput

J9

Start Contactor (1M)

Run Contactor (2M)

Shunt Trip

Pump Controls

Tower Fan

Trip Alarm

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PIC II -- ISM Module

J3 Voltage Inputs
Line 1 – L1
Line 2 – L2
Line 3 – L3

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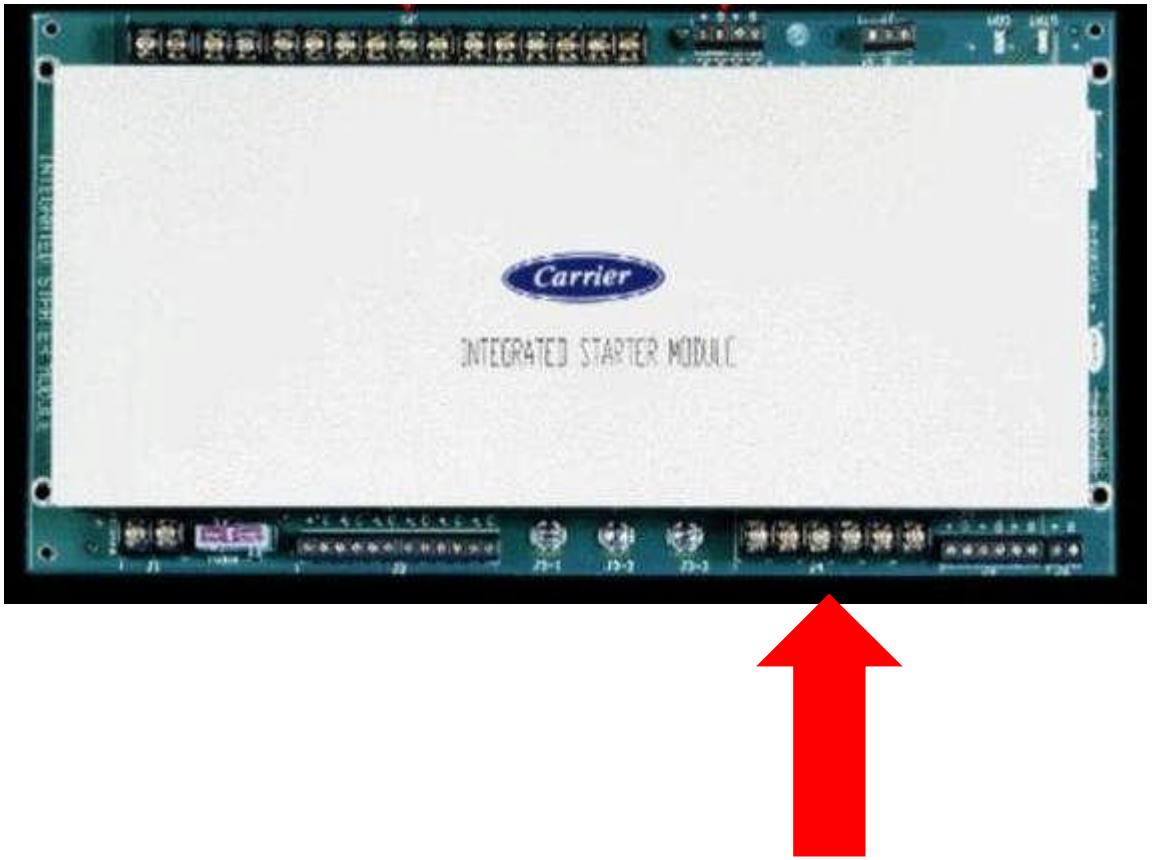
PIC II -- ISM Module



J4
LINE Current Inputs
IL1
IL2
IL3

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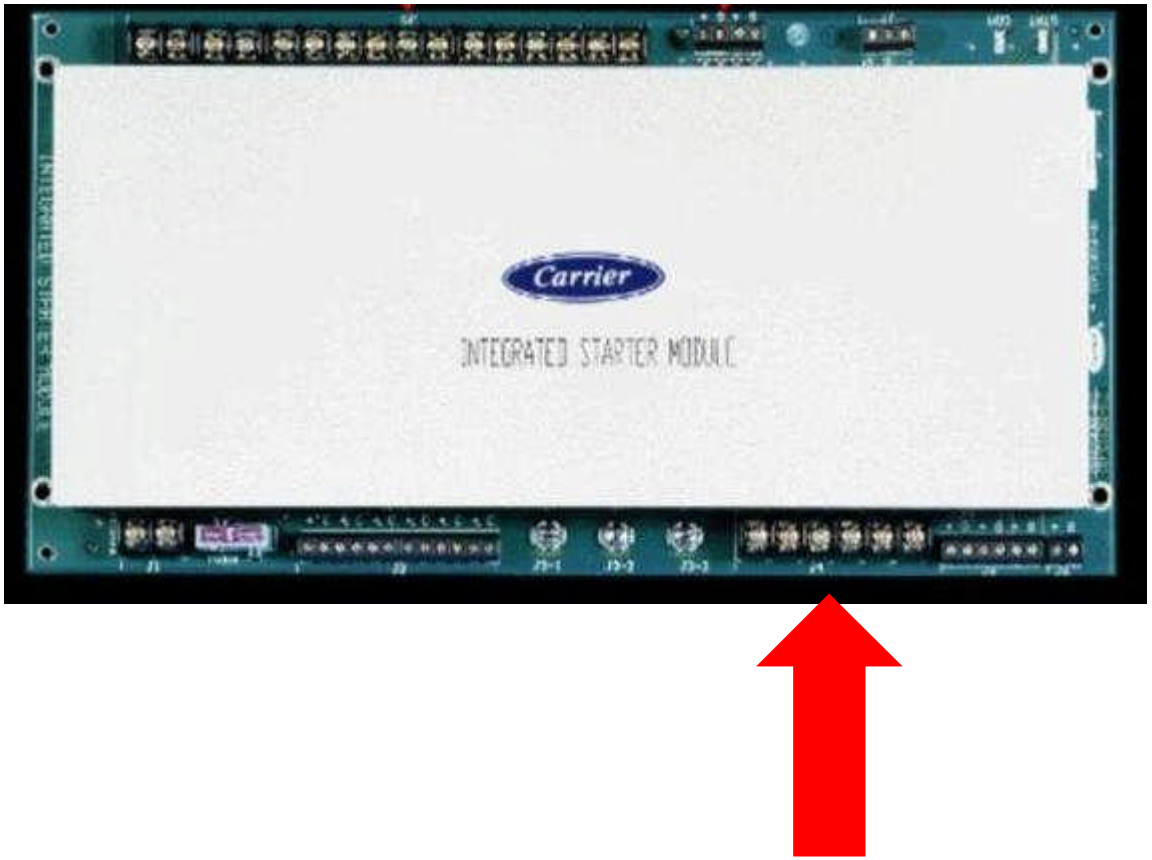
PIC II -- ISM Module



J4
GROUND FAULT
Current
T1/T4
T2/T5
T3/T6

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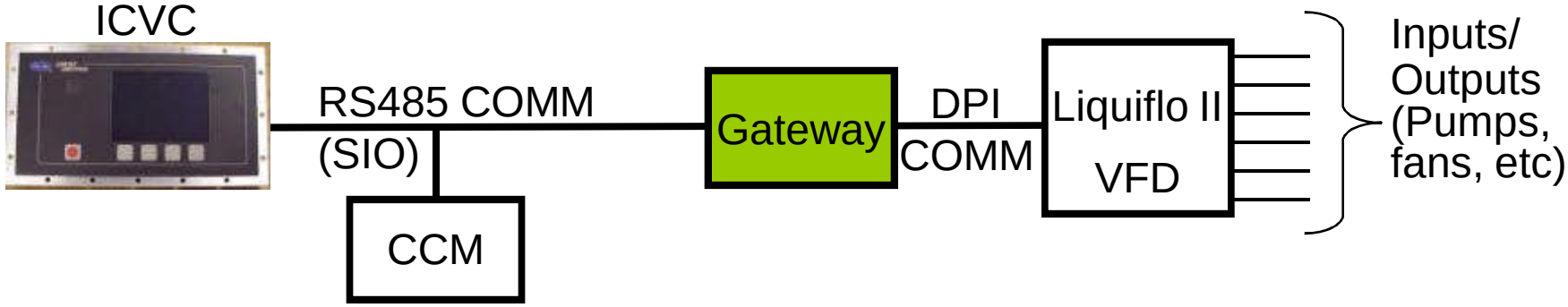
PIC III – Gateway/DPI

PIC III



DPI -- Drive Peripheral Interface

PIC III Controls

Rockwell LF2, Allen Bradley PF755, Eaton, Benshaw Wye Delta, Benshaw Solid state

Ability to communicate directly with ICVC

All controls via ISM will be part of the drive (covered under individual drive training)

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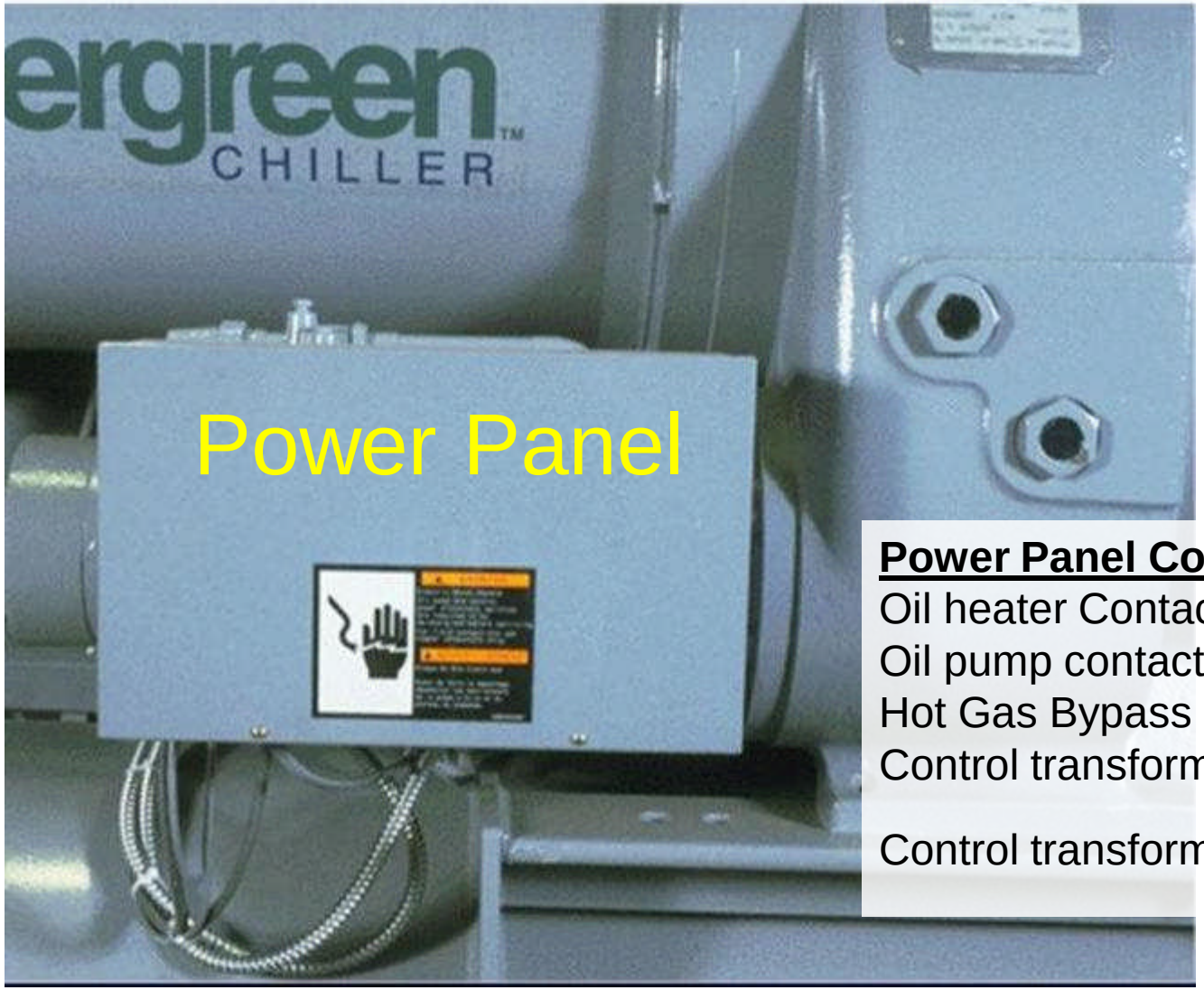
Power Panel



Power Panel Components

Oil heater Contactor (1C)
Oil pump contactor (2C)
Hot Gas Bypass Relay (3C) Optional
Control transformers (T1, T2)

Control transformers (T3) optional

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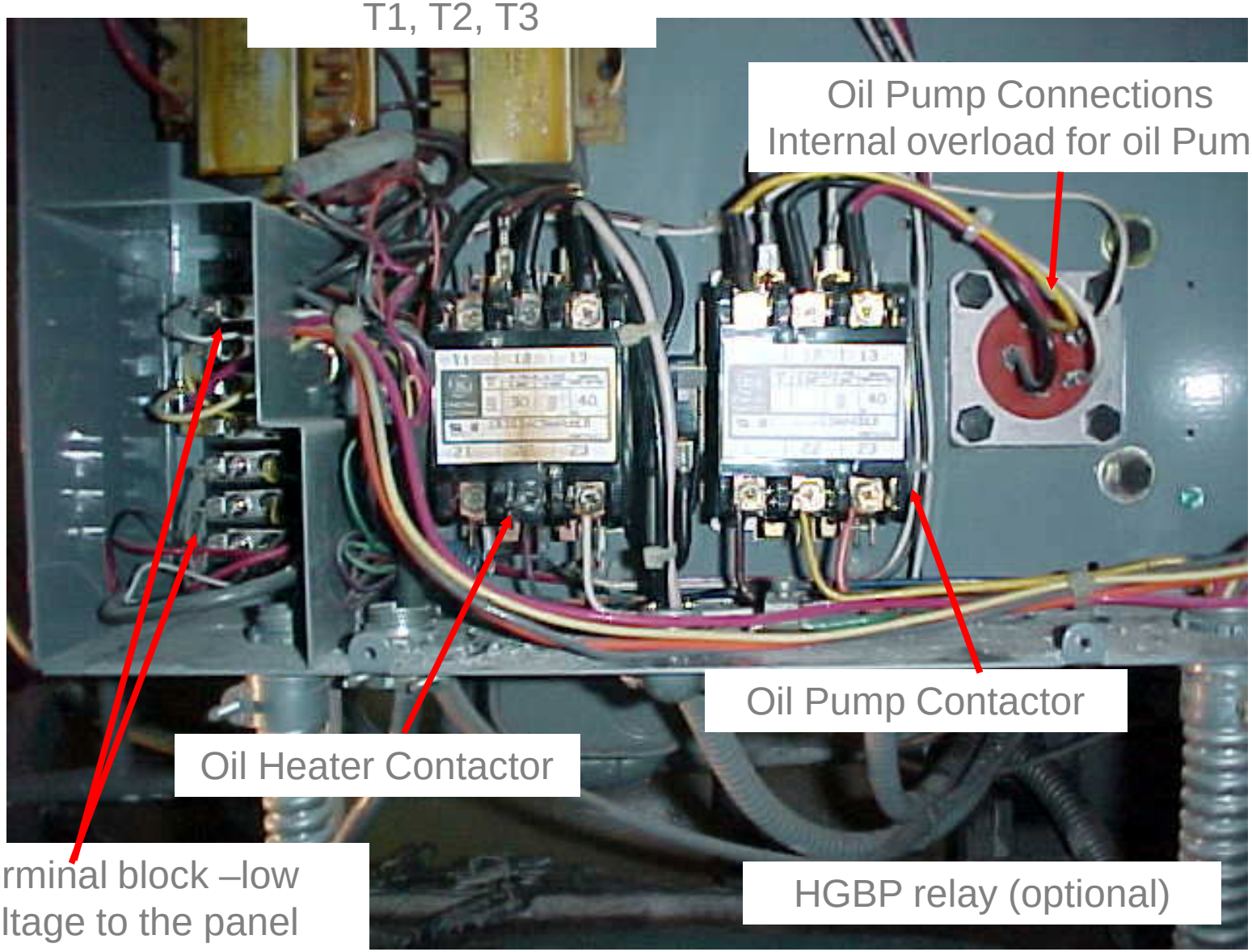
Power Panel



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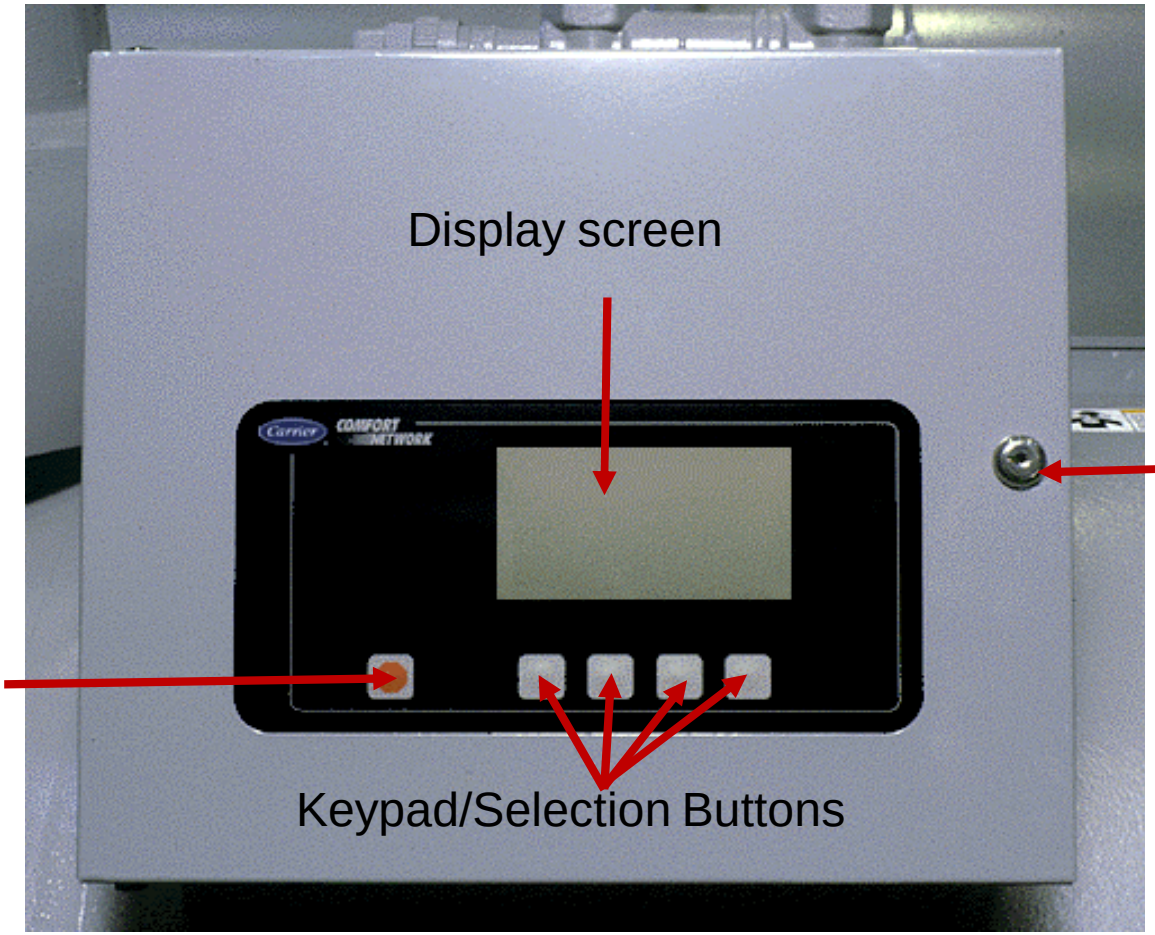
Control Panel - Front



Also called “ICVC” – International Chiller Visual Controller

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ICVC Default Screen

Date/Time
Run Hours
Chiller Status
Evaporator Refrigerant Temp
Chilled water In/Out Temp
Condenser Refrigerant Temp
Cond water In/Out Temp
% Amps
Oil Temp
Oil Pressure

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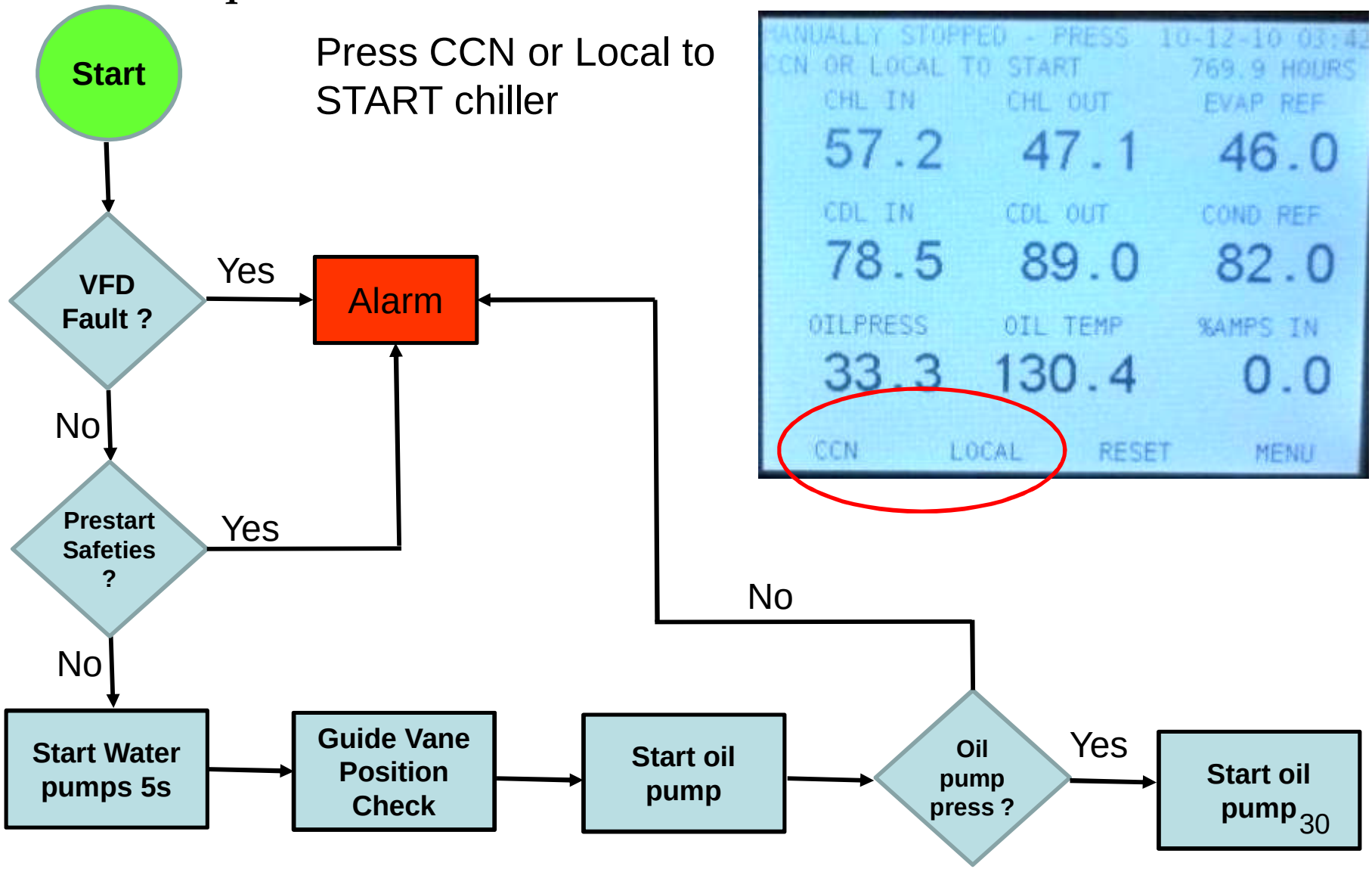
Start Sequence

Carrier
Turn to the Experts



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Safety Controls

High Bearing Temp
High Motor Winding temp
High Discharge Temp
Low Discharge Superheat
Low Oil Pressure
Low Cooler Ref Temp/Press
Condenser High/Low Pressure
Inadequate Flow
High/Low/Loss of Voltage
Ground Fault
Voltage/Current Imbalance
Excessive motor acceleration time
Excessive starter transition time
Lack of Motor Current Signal

Excessive motor amps
Excessive compressor surge
Temp/Transducers Faults
VFD power faults
VFD Over Temp
Dew Formation

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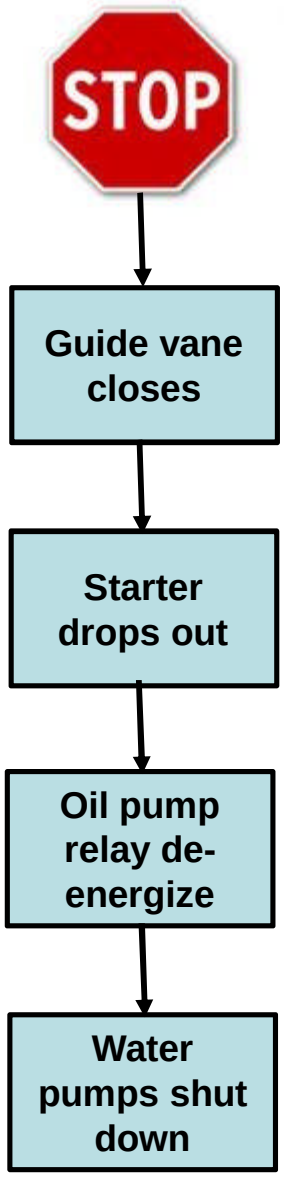
Shutdown Sequence

A SHUTDOWN command is initiated
Guide vane closes
Chiller unload
Starter Drops out
Oil pump relay de-energize
Water pumps shut down (criteria check)



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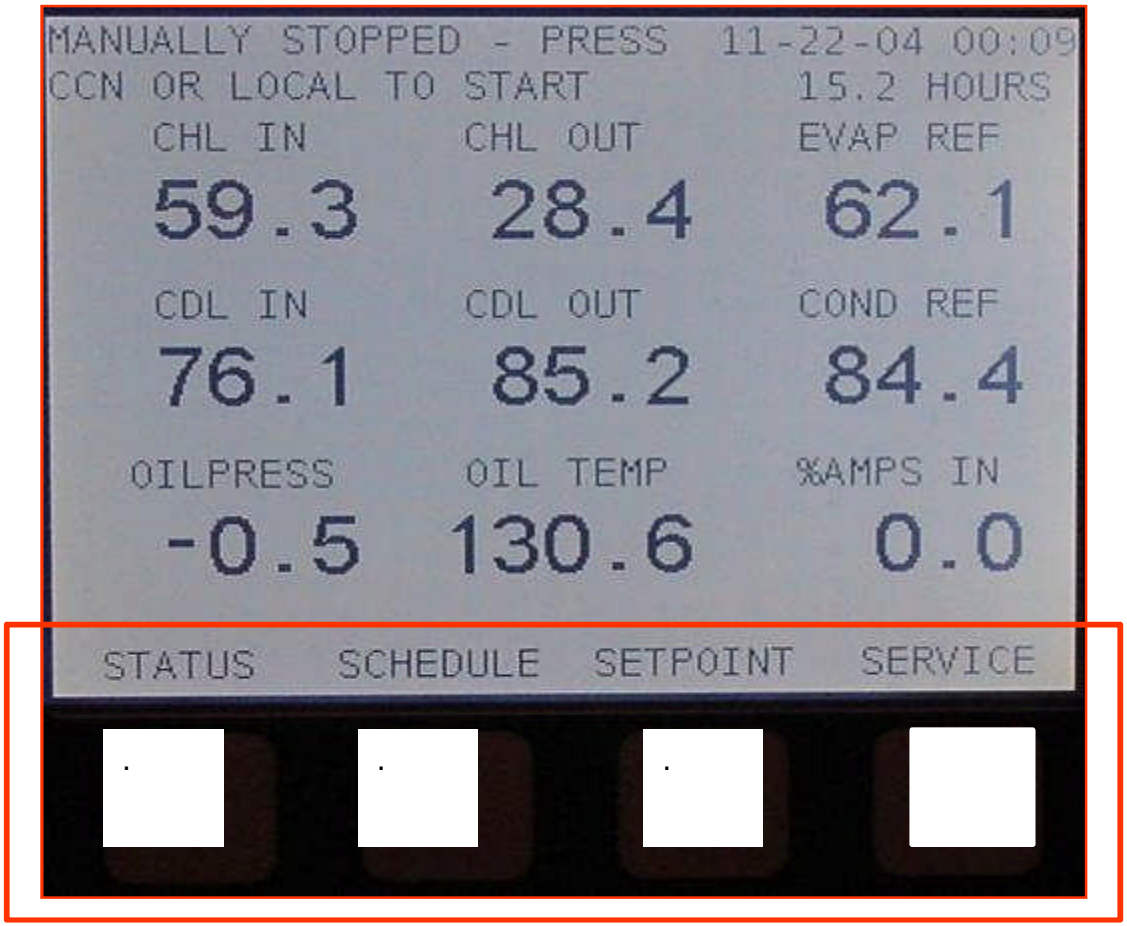
ICVC Menu



1. **Service** – To all controls and settings
2. **Setpoint** – Chilled water setpoint menu
3. **Schedule** – Chiller schedule
4. **Status** – To all status screen

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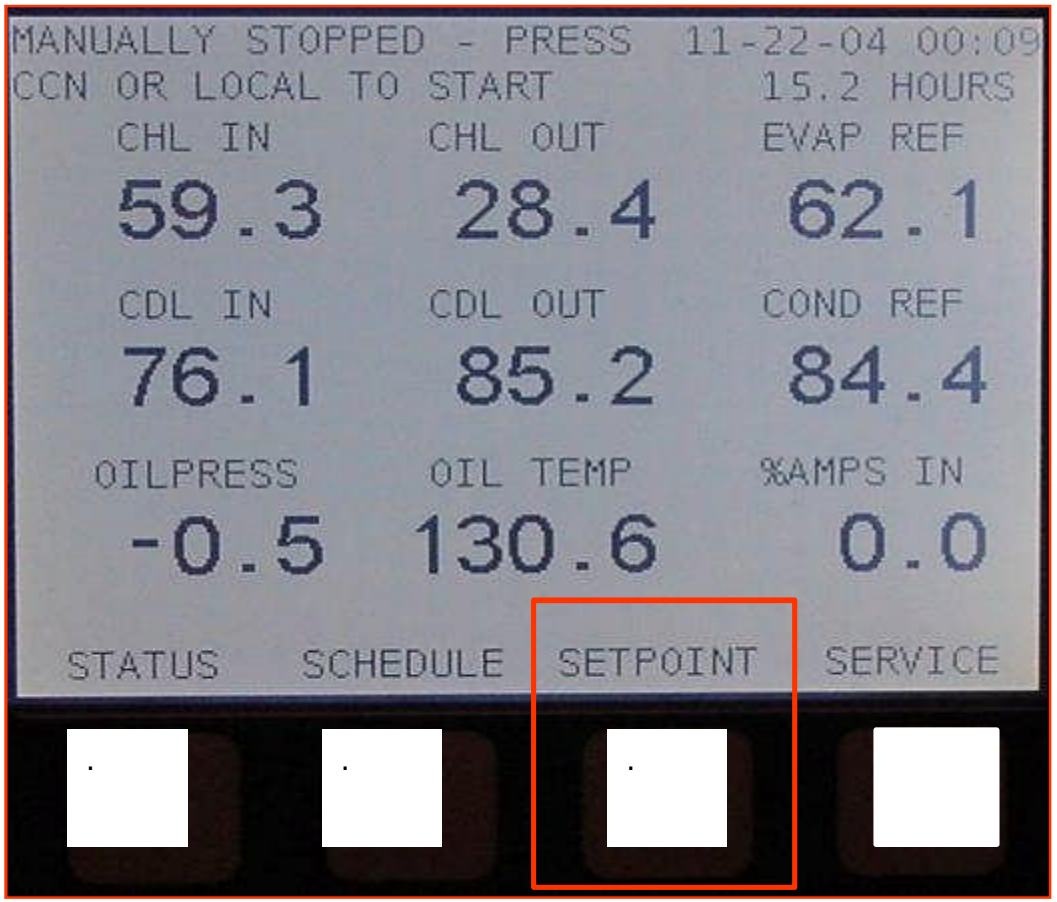
ICVC Menu



Chilled water set point
Go to Setpoint

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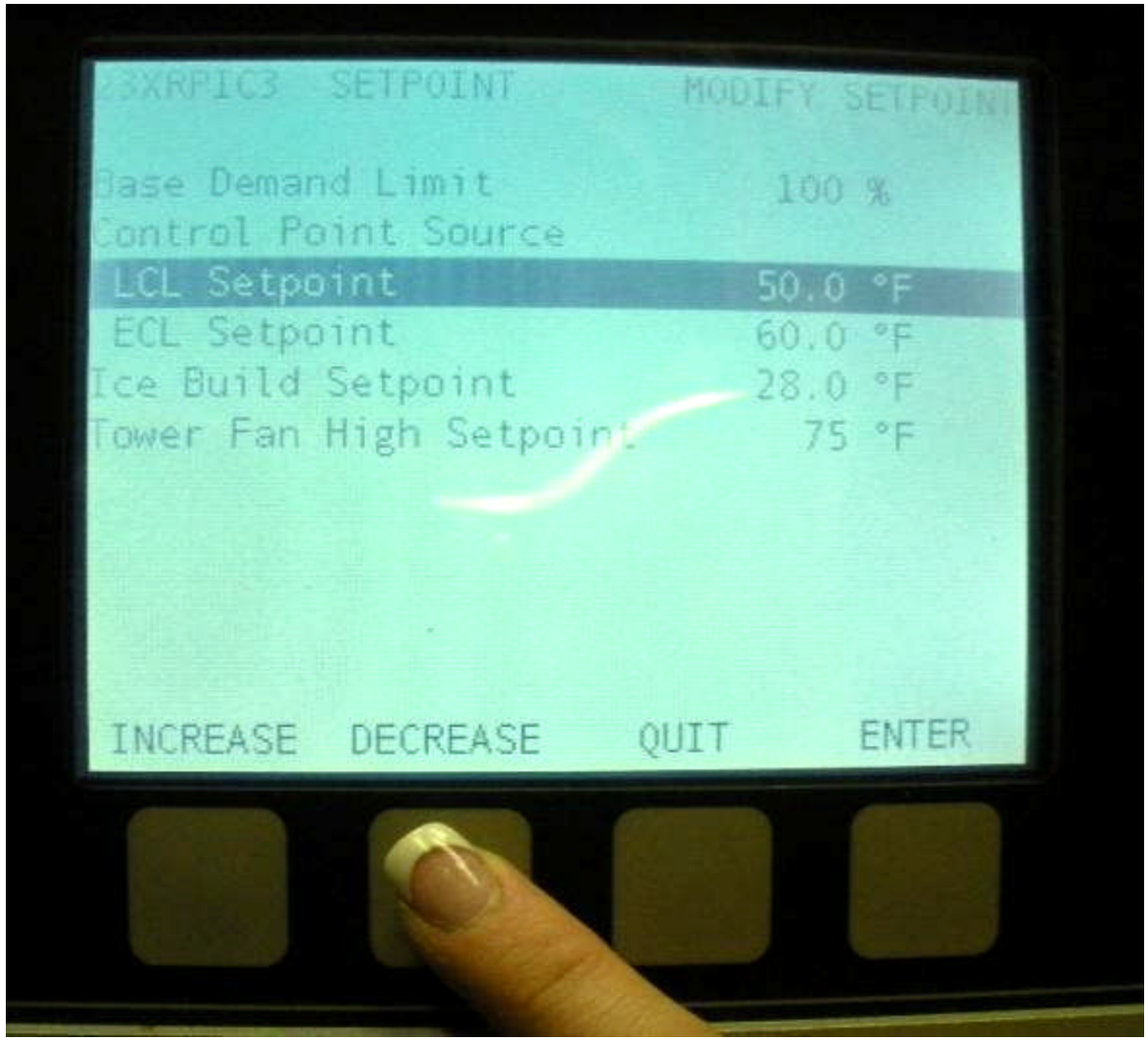
Menu →Setpoint



Chilled water set point can be changed on this screen

Press Increase/Decrease button to change set point value

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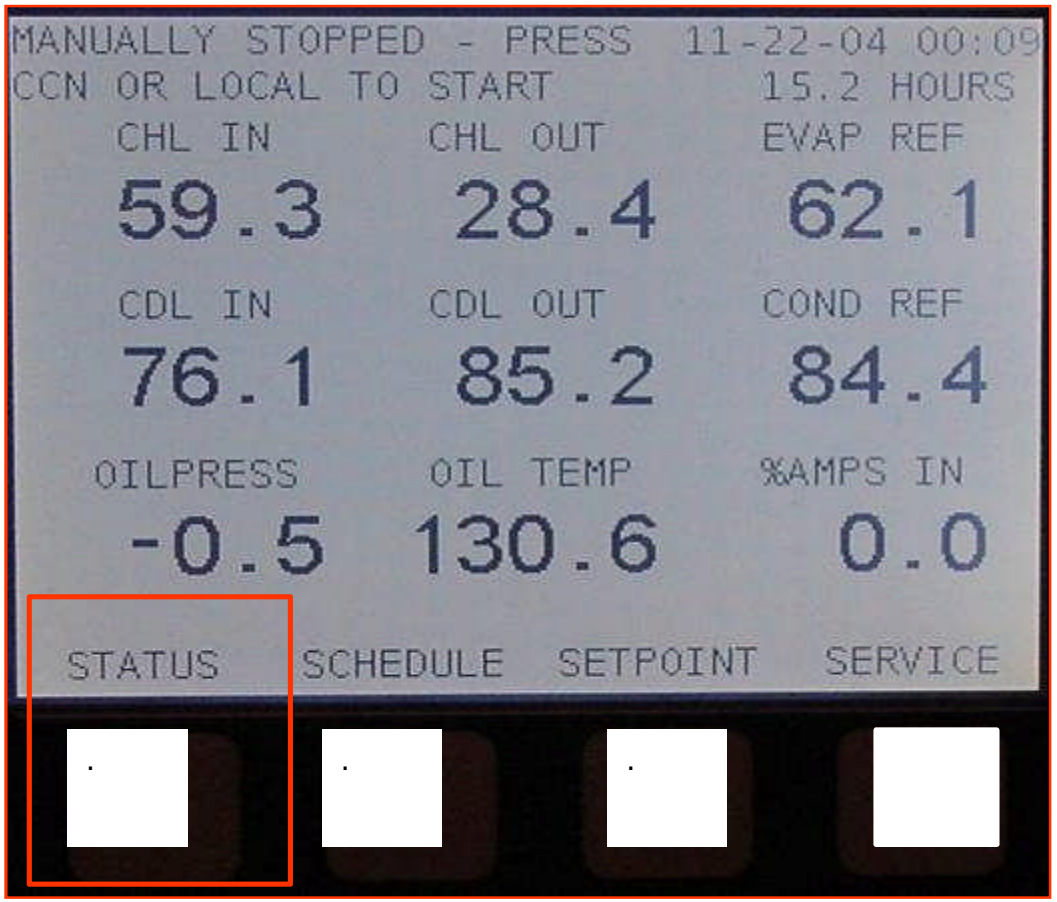
ICVC Menu



Look at machine status
Go to Status

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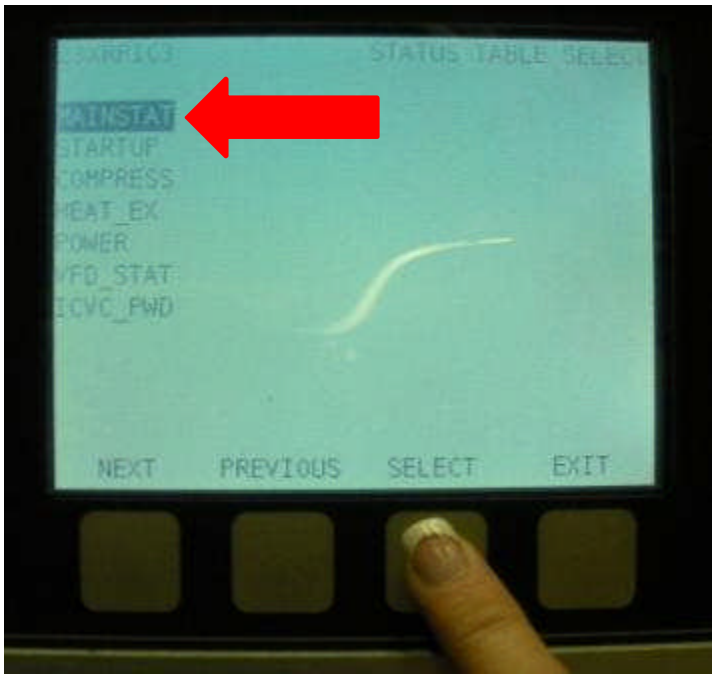
Menu → Status → MAINSTAT



DESCRIPTION
Control Mode
Run Status
Start Inhibit Timer
Occupied?
System Alert/Alarm
*Chiller Start/Stop
*Remote Start Contact
Temperature Reset
*Control Point
Chilled Water Temp
*Active Demand Limit
Average Line Current
Motor Percent Kilowatts
Auto Demand Limit Input
Auto Chilled Water Reset
Remote Reset Sensor
Total Compressor Starts
Starts in 12 Hours
Compressor Ontime
*Service Ontime
Ice Build Contact
Refrigerant Leak Sensor

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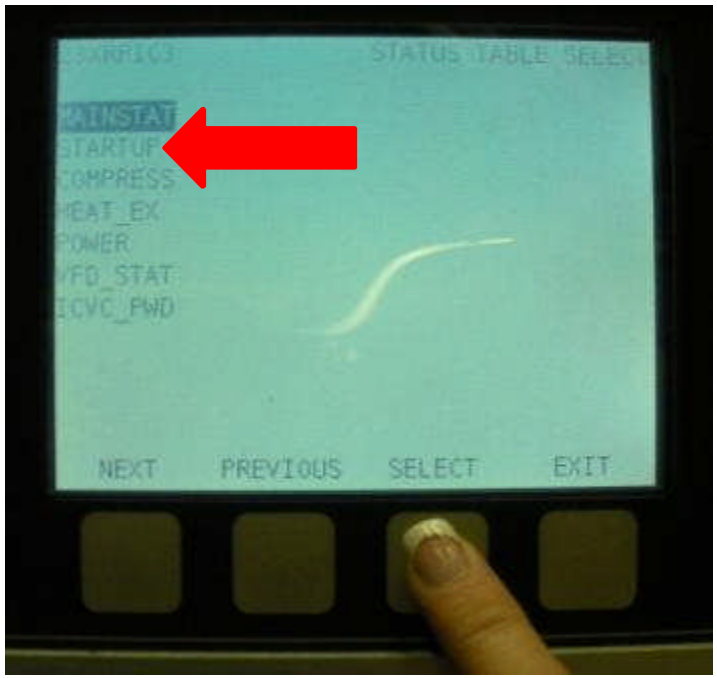
Menu → Status → STARTUP



DESCRIPTION
Actual Guide Vane Pos
**Chilled Water Pump
Chilled Water Flow
**Condenser Water Pump
Condenser Water Flow
Oil Pump Relay
**Oil Pump Delta P
Compressor Start Relay
Compressor Start Contact
Starter Trans Relay
Compressor Run Contact
**Tower Fan Relay Low
**Tower Fan Relay High
Starter Fault
Spare Safety Input
Shunt Trip Relay
ISM Fault Status

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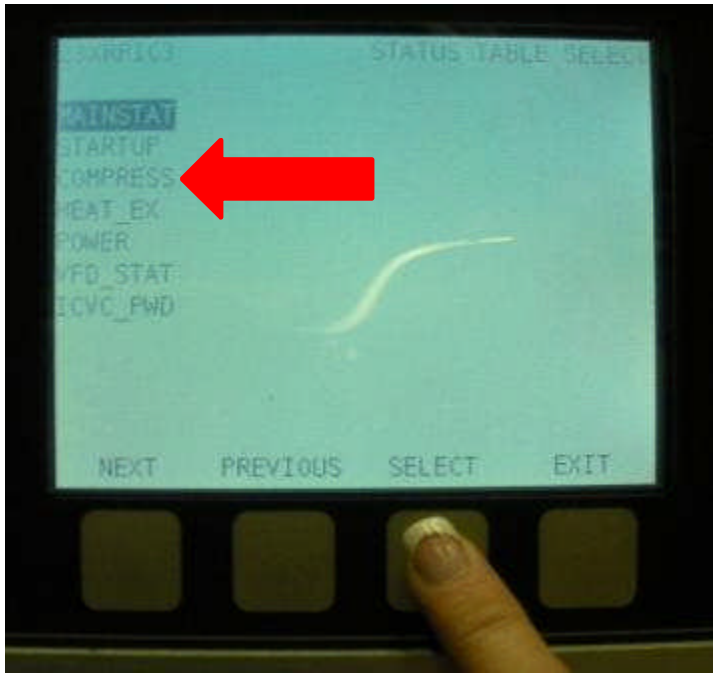
Menu → Status → COMPRESS



DESCRIPTION
Actual Guide Vane Pos
Guide Vane Delta
**Target Guide Vane Pos
Oil Sump Temp
**Oil Pump Delta P
Comp Discharge Temp
Comp Thrust Brg Temp
Comp Motor Winding Temp
Spare Temperature 1
Spare Temperature 2
Oil Heater Relay
Diffuser Actuator
**Target VFD Speed
**Actual VFD Speed
Surge Protection Counts

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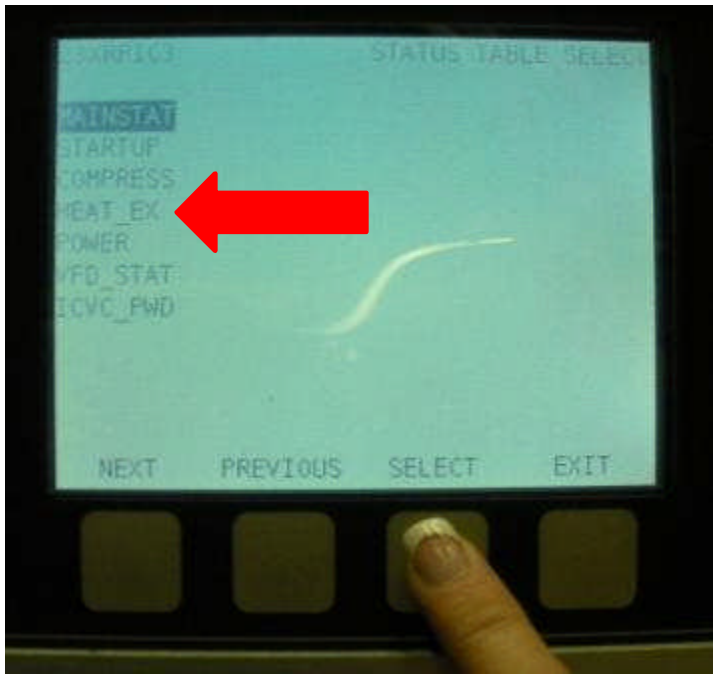
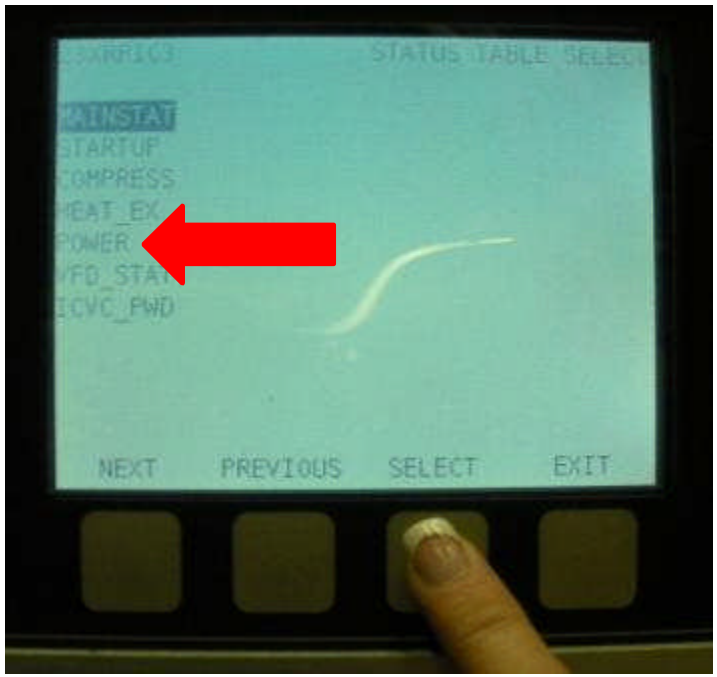
Menu → Status → HEAT_EX



DESCRIPTION
**Chilled Water Delta P
Entering Chilled Water
Leaving Chilled Water
Chilled Water Delta T
Chill Water Pulldown/Min
Evaporator Refrig Temp
**Evaporator Pressure
Evaporator Approach
**Condenser Water Delta P
Entering Condenser Water
Leaving Condenser Water
Condenser Refrig Temp
**Condenser Pressure
Condenser Approach
Hot Gas Bypass Relay
Surge / HGBP Active?
Active Delta P
Active Delta T
Surge / HGBP Delta T
Head Pressure Reference
Evaporator Saturation Temp (ICVC only)

19XRV

Menu → Status → POWER



DESCRIPTION
Average Line Current
Actual Line Current
Average Line Voltage
Actual Line Voltage
Power Factor
Motor Kilowatts
**Motor Kilowatt-Hours
Demand Kilowatts
Line Current Phase 1
Line Current Phase 2
Line Current Phase 3
Line Voltage Phase 1
Line Voltage Phase 2
Line Voltage Phase 3
Ground Fault Phase 1
Ground Fault Phase 2
Ground Fault Phase 3
Frequency
I2T Sum Heat-Phase 1
I2T Sum Heat-Phase 2
I2T Sum Heat-Phase 3

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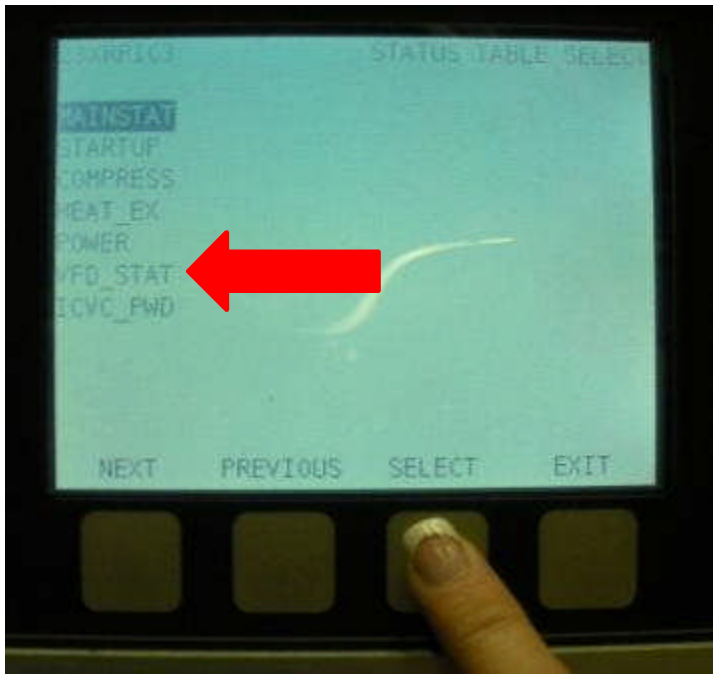
Menu → Status → VFD_STAT



DESCRIPTION
ISM Fault Status
Single Cycle Dropout
Phase Loss
Overvoltage
Undervoltage
Current Imbalance
Voltage Imbalance
Overload Trip
Locked Rotor Trip
Starter LRA Trip
Ground Fault
Phase Reversal
Frequency Out of Range
ISM Power on Reset
Phase 1 Fault
Phase 2 Fault
Phase 3 Fault
1CR Start Complete
1M Start/Run Fault
2M Start/Run Fault
Pressure Trip Contact
Starter Fault
Motor Amps Not Sensed
Starter Acceleration Fault
High Motor Amps
1CR Stop Complete
1M/2M Stop Fault
Motor Amps When Stopped
Hardware Failure

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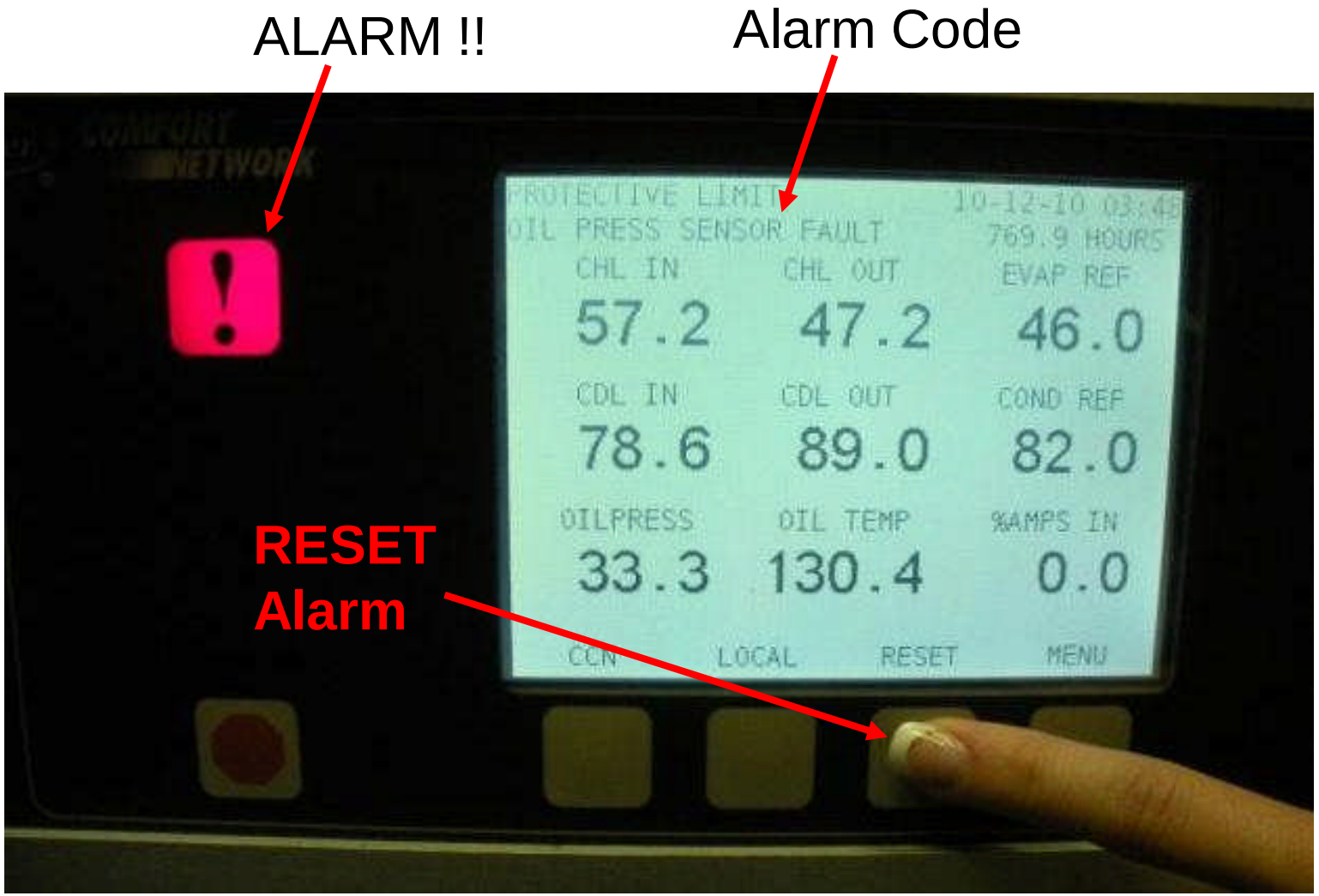
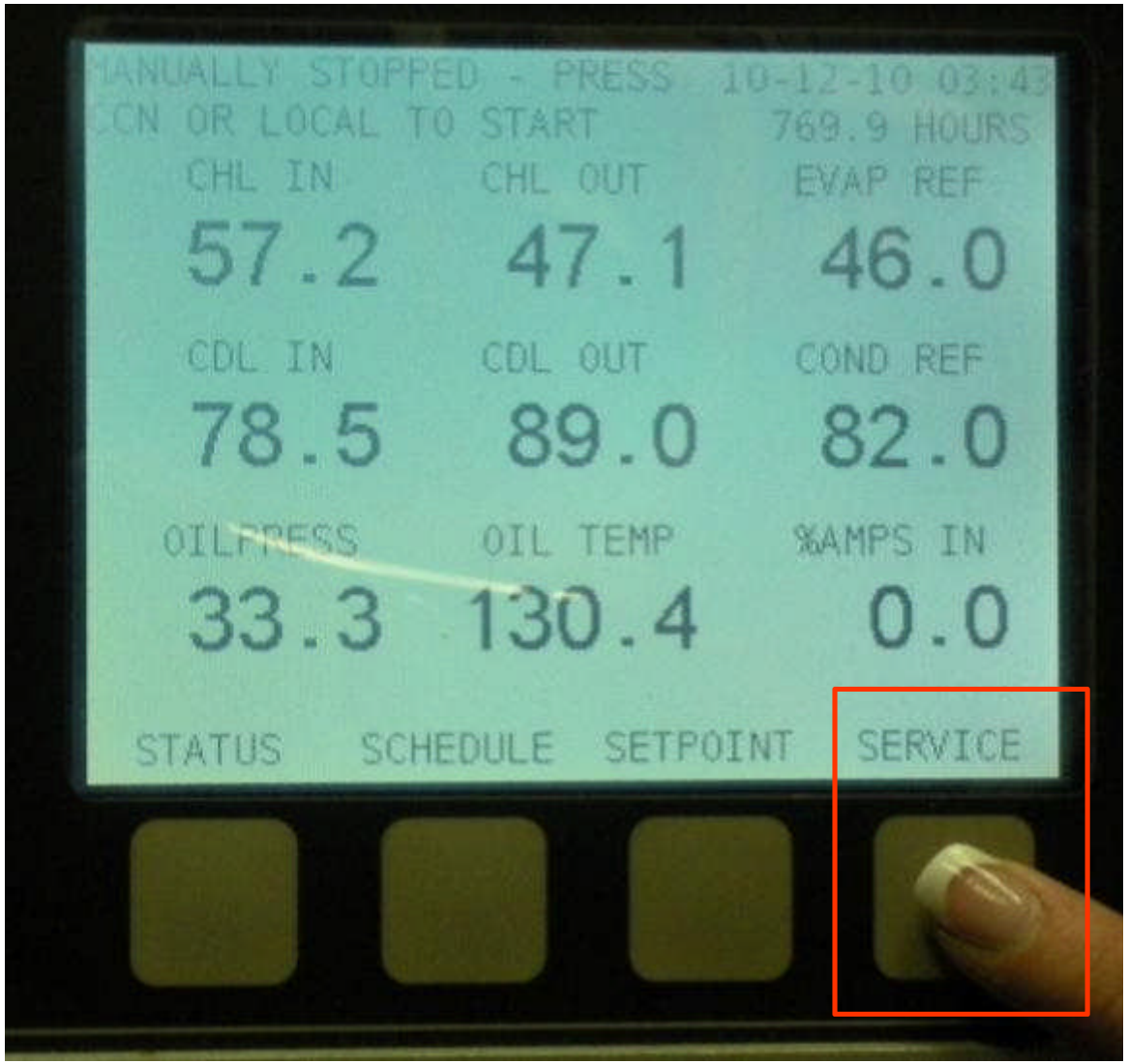
Chiller Alarm



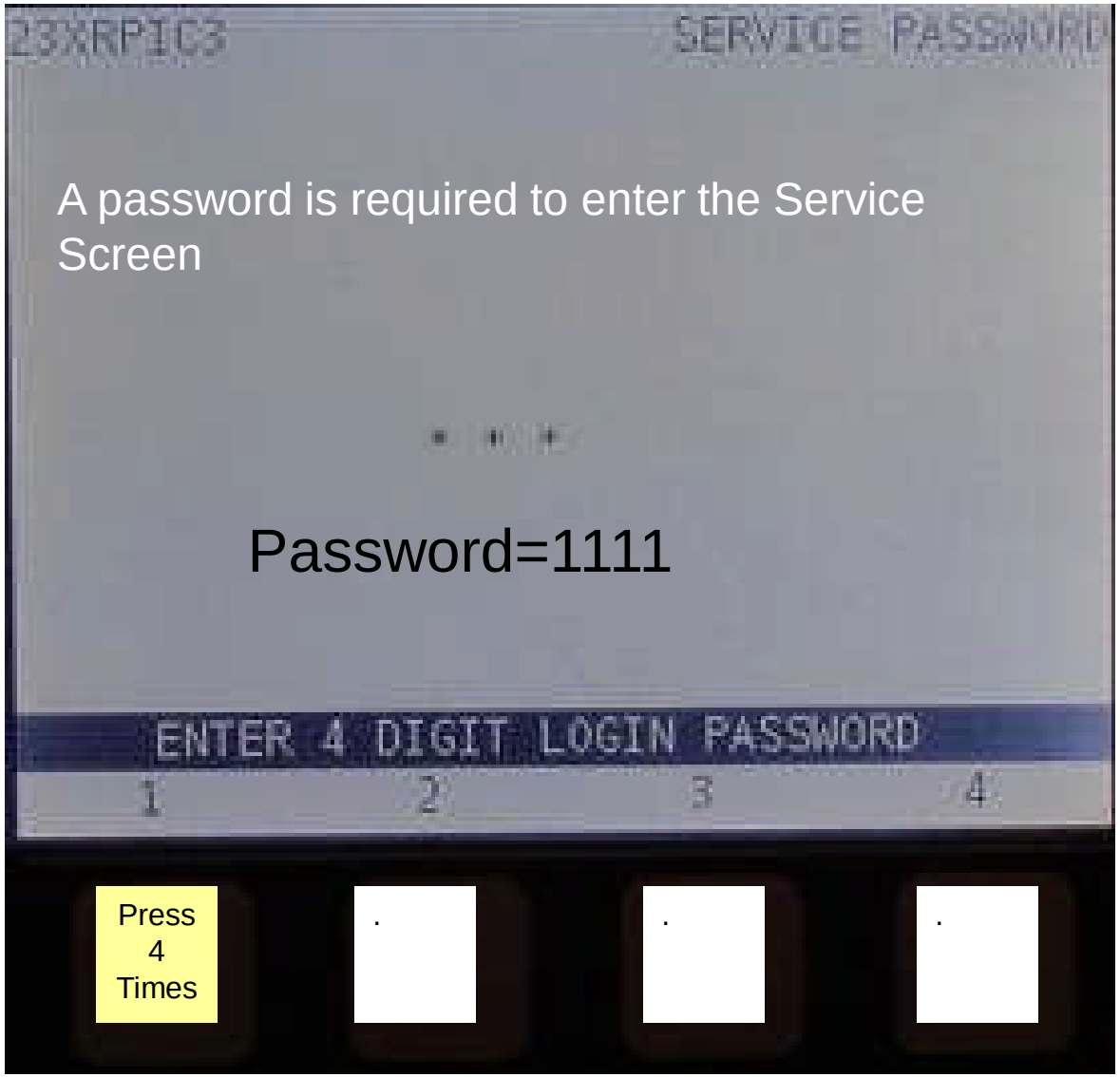
19XRV

Menu → Service



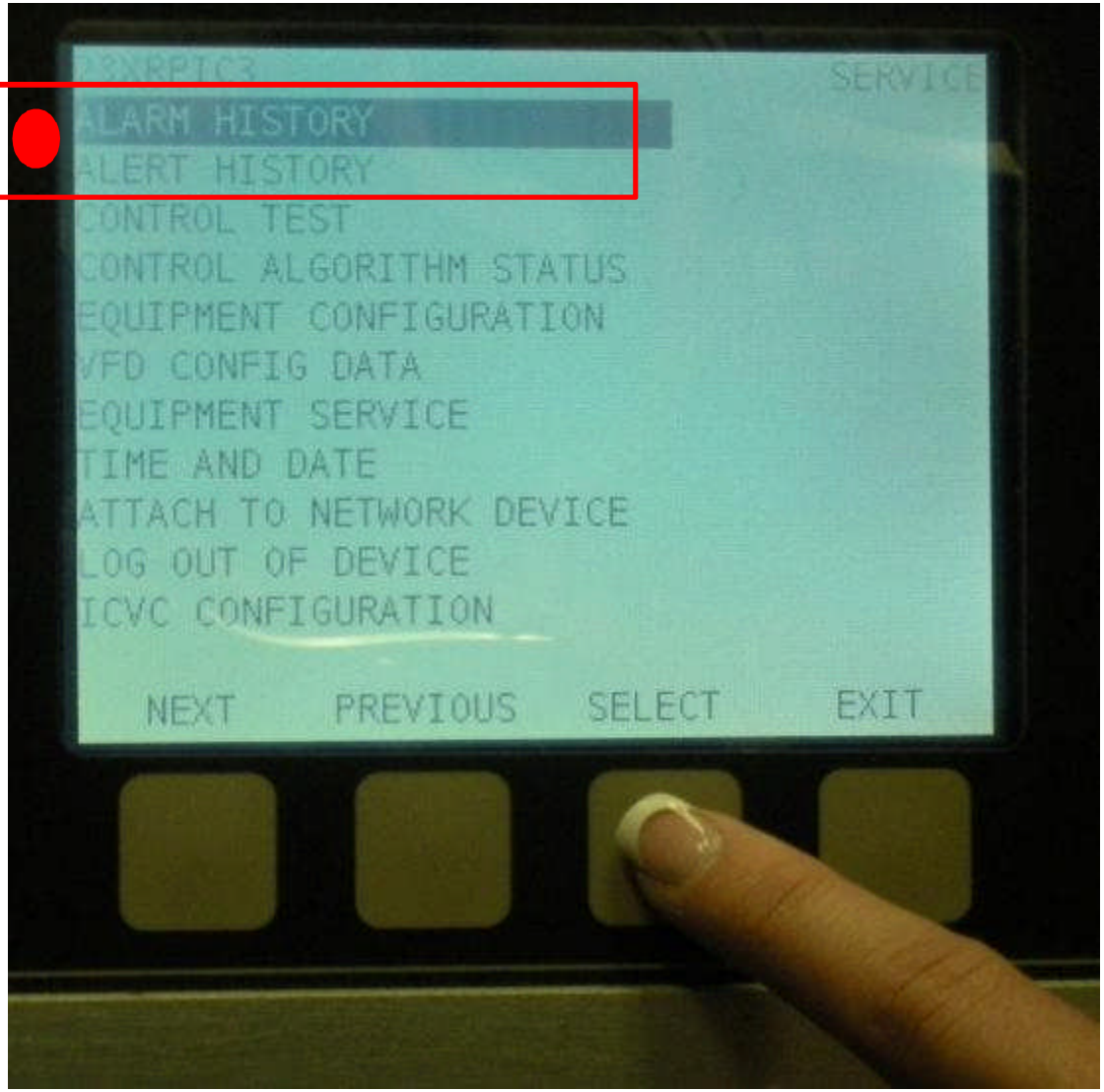
19XRV

Menu → Service



19XRV

Service →Alarm & Alert history



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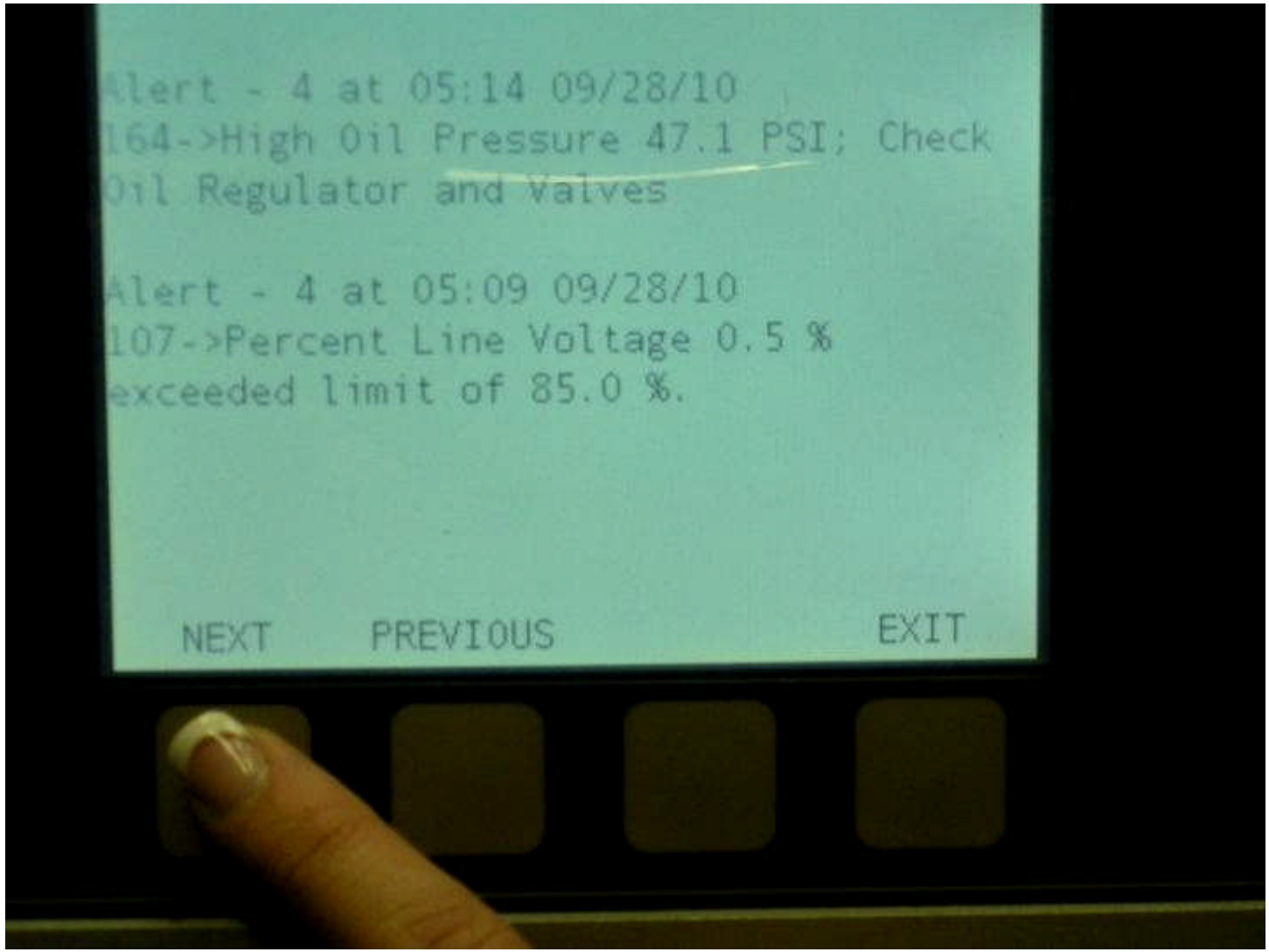
Service → Alarm History



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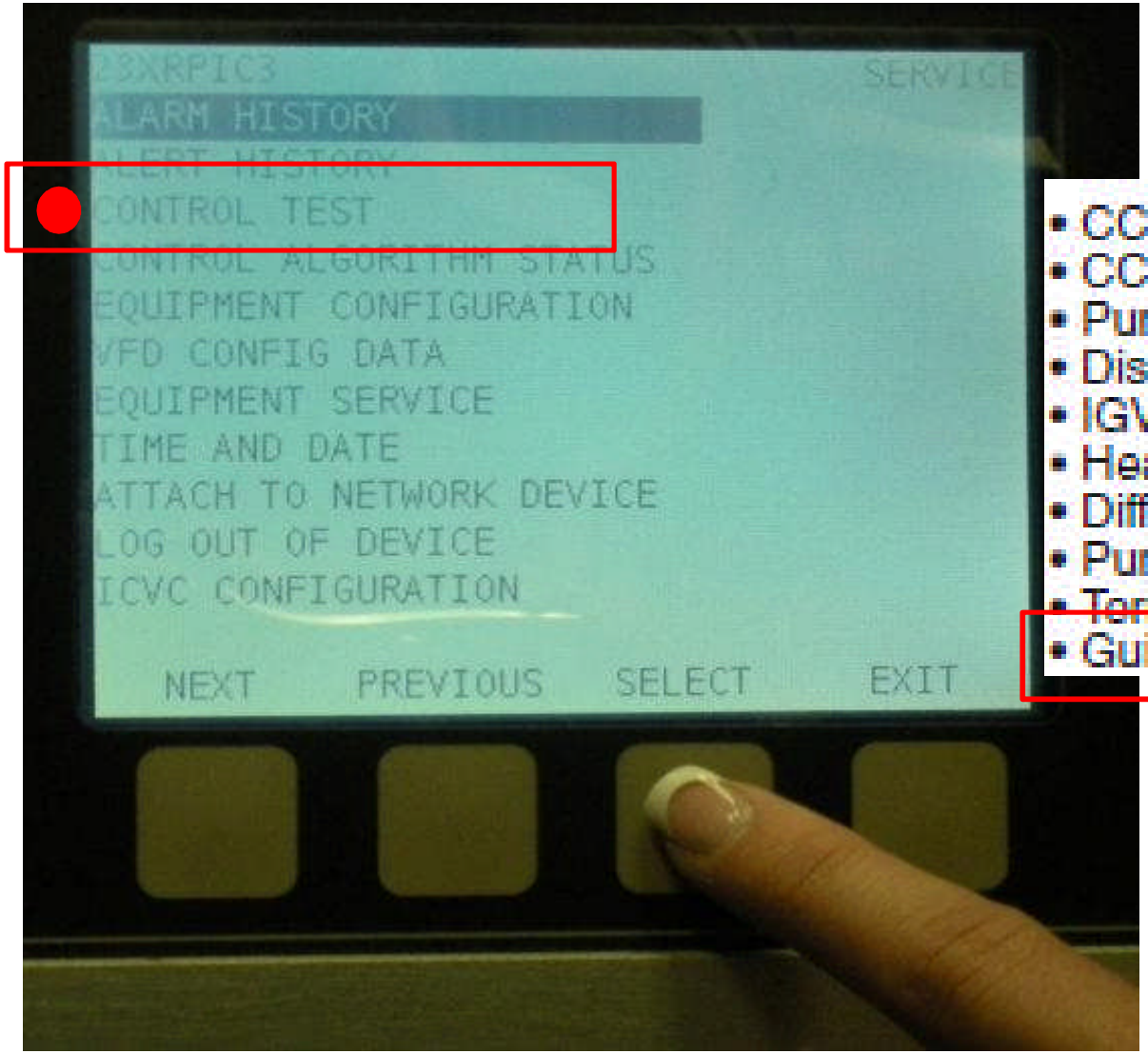
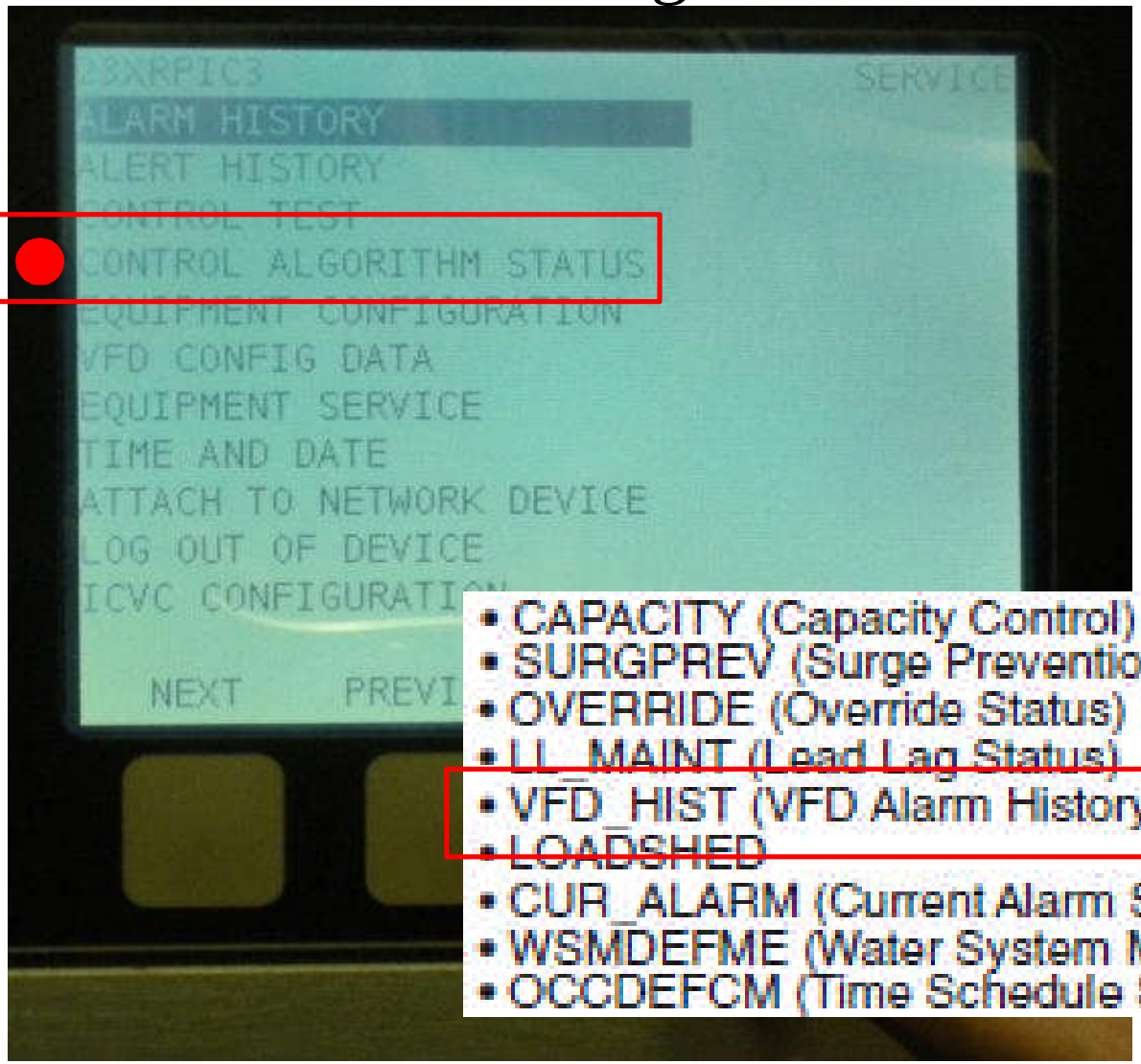
Service → Control Test



- CCM Thermistors
- CCM Pressure Transducers
- Pumps
- Discrete Outputs
- IGV and SRD Actuator
- Head Pressure Output
- Diffuser Actuator
- Pumpdown/Lockout
- Terminate Lockout
- Guide Vane Calibration

19XRV

Service → Control Algorithm Status



- CAPACITY (Capacity Control)
- SURGPREV (Surge Prevention)
- OVERRIDE (Override Status)
- LL_MAINT (Lead Lag Status)
- VFD_HIST (VFD Alarm History)
- LOADSHED
- CUR_ALARM (Current Alarm State)
- WSMDEFME (Water System Manager Control Status)
- OCCDEFCM (Time Schedule Status)

19XRV

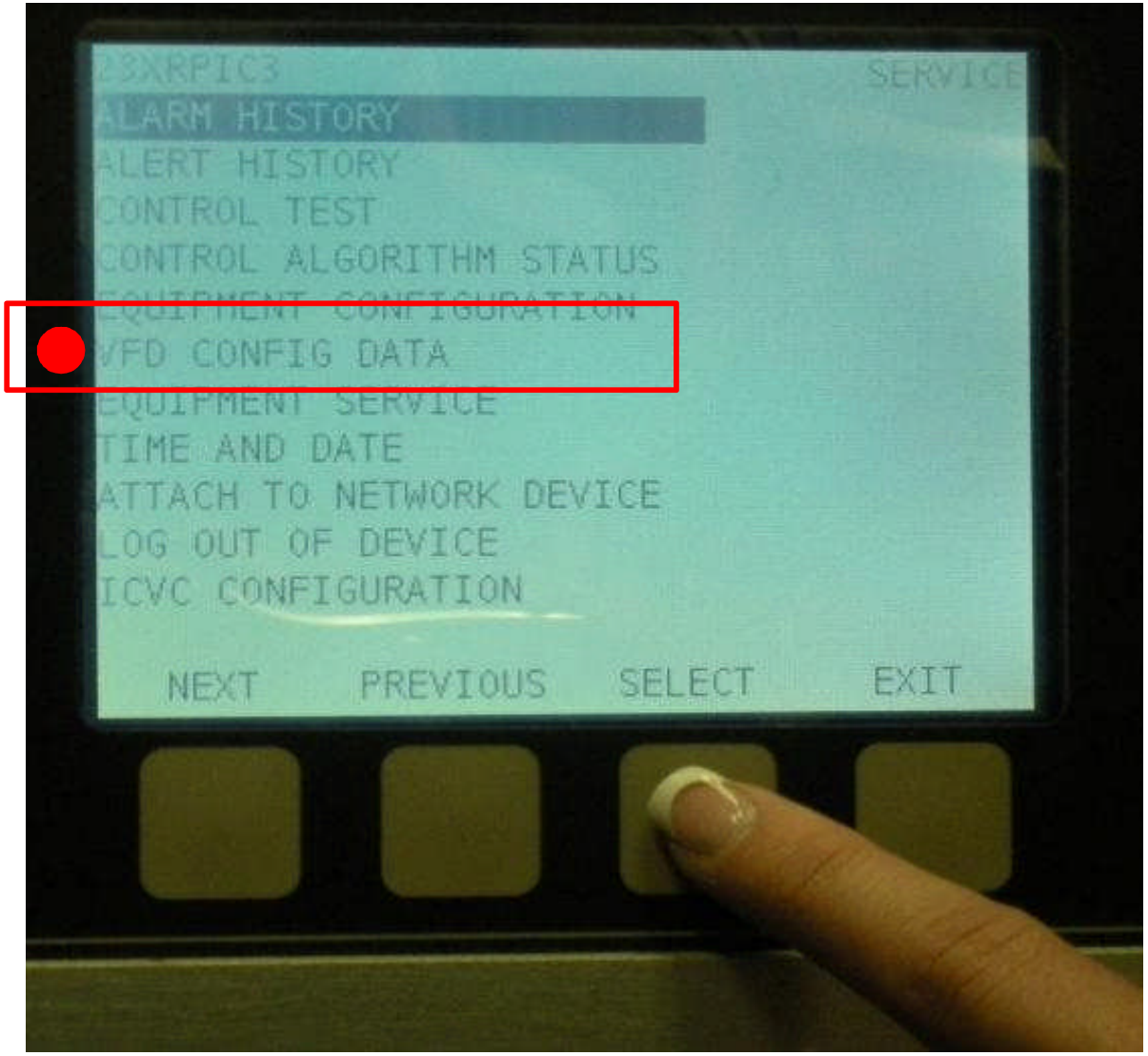
Control Algorithm Status → VFD HIstory

DESCRIPTION	STATUS
VFD FAULT HISTORY	
Values at Last Fault:	
Line Current Ph1(R)	0.0-99999.0
Line Current Ph2(S)	0.0-99999.0
Line Current Ph3(T)	0.0-99999.0
Load Current Ph1(U)	0.0-99999.0
Load Current Ph2(V)	0.0-99999.0
Load Current Ph3(W)	0.0-99999.0
Line Voltage Ph1(RS)	0.0-99999.0
Line Voltage Ph2(ST)	0.0-99999.0
Line Voltage Ph3(TR)	0.0-99999.0
Ground Fault Current	0.0-999.0
Line Frequency	0.0-99.0
Line Power Factor	0.00-2.00
Line Current Imbalance	0.0-100.0
Line Voltage Imbalance	0.0-100.0
Motor Power Factor	0.00-2.00
Motor Current Imbalance	0.0-100.0
Motor Overload	0.0-100.0
Line Active Current	0.0-99999.0
Line Reactive Current	0.0-99999.0
Line Active Voltage	0.0-99999.0
Line Reactive Voltage	0.0-99999.0
DC Bus Voltage	0.0-99999.0
DC Bus Voltage Reference	0.0-99999.0
Flux Current	0.0-99999.0
Torque Current	0.0-99999.0
Inverter Temperature	0.0-300.0
Rectifier Temperature	0.0-300.0
VFD Enclosure Temp	0.0-300.0
VFD Cold Plate Temp	0.0-300.0
Actual VFD Speed	0.0-100.0
Comp Motor RPM	NOTE 2
Comp Motor Frequency	NOTE 2
Chiller Fault State	200-225
VFD Fault Code	200-225

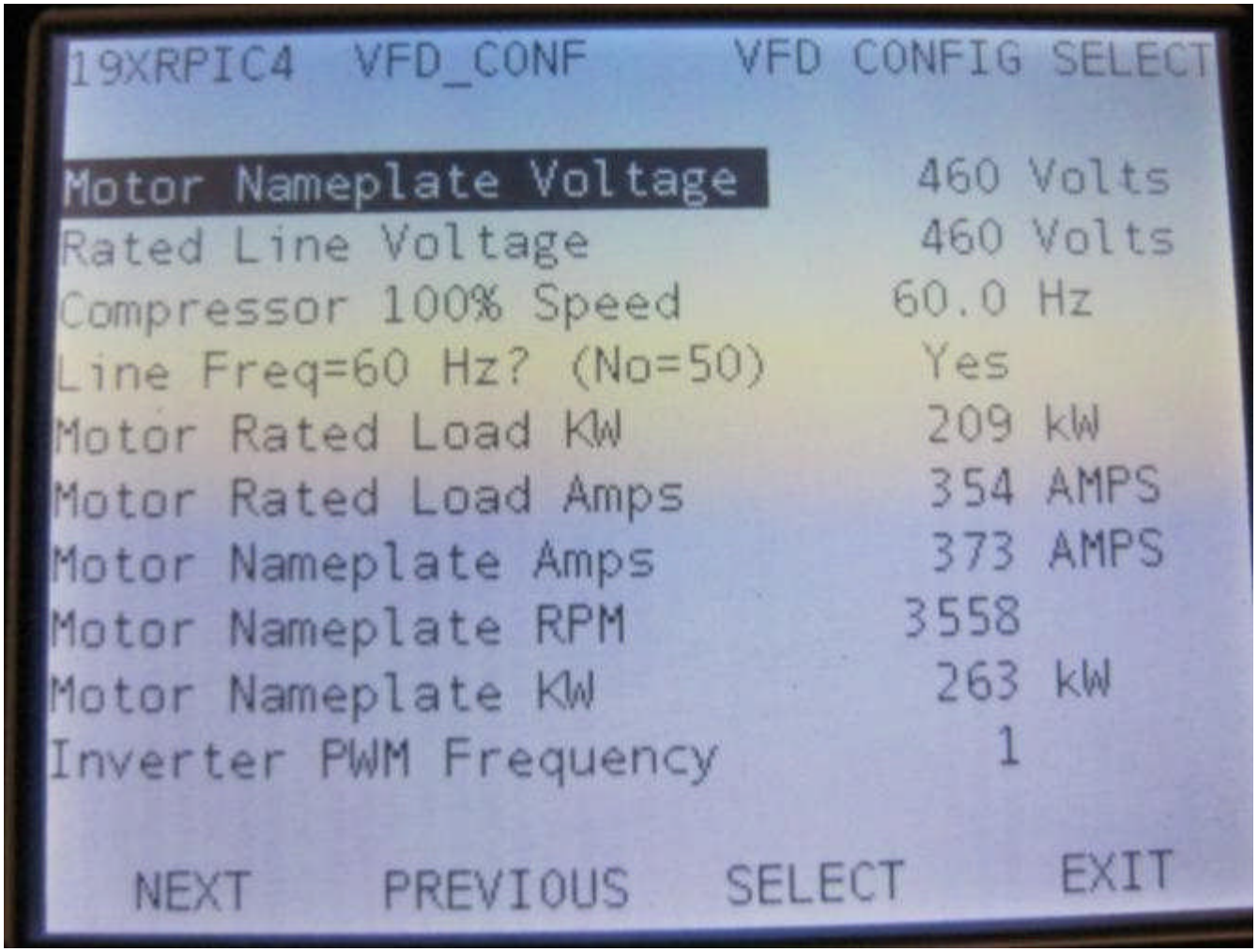
Recorded items during last failure

19XRV

PIC III



19XRV
VFD Config



Program VFD Config information carefully and make sure that all configurations are correct

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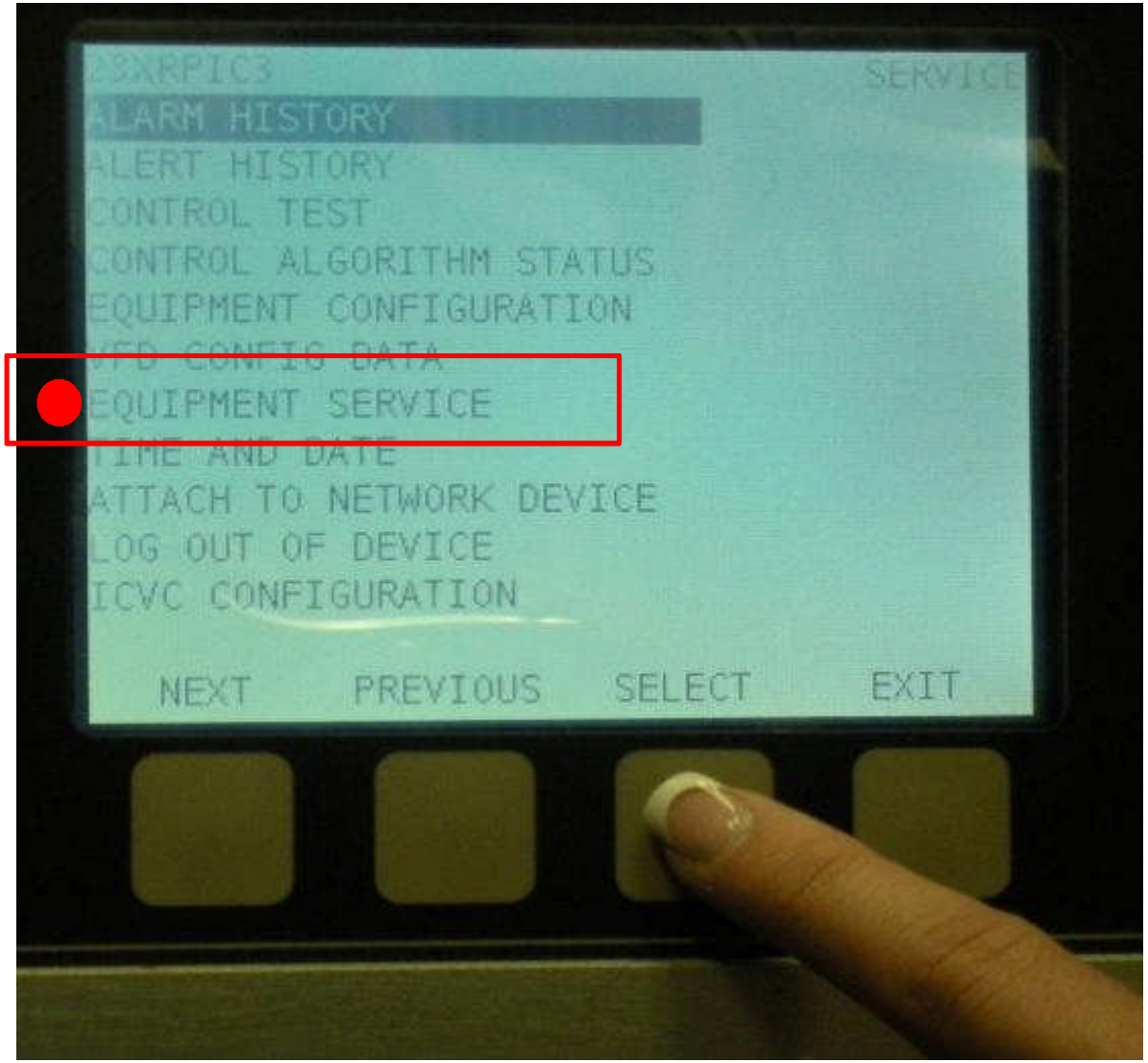
PIC III

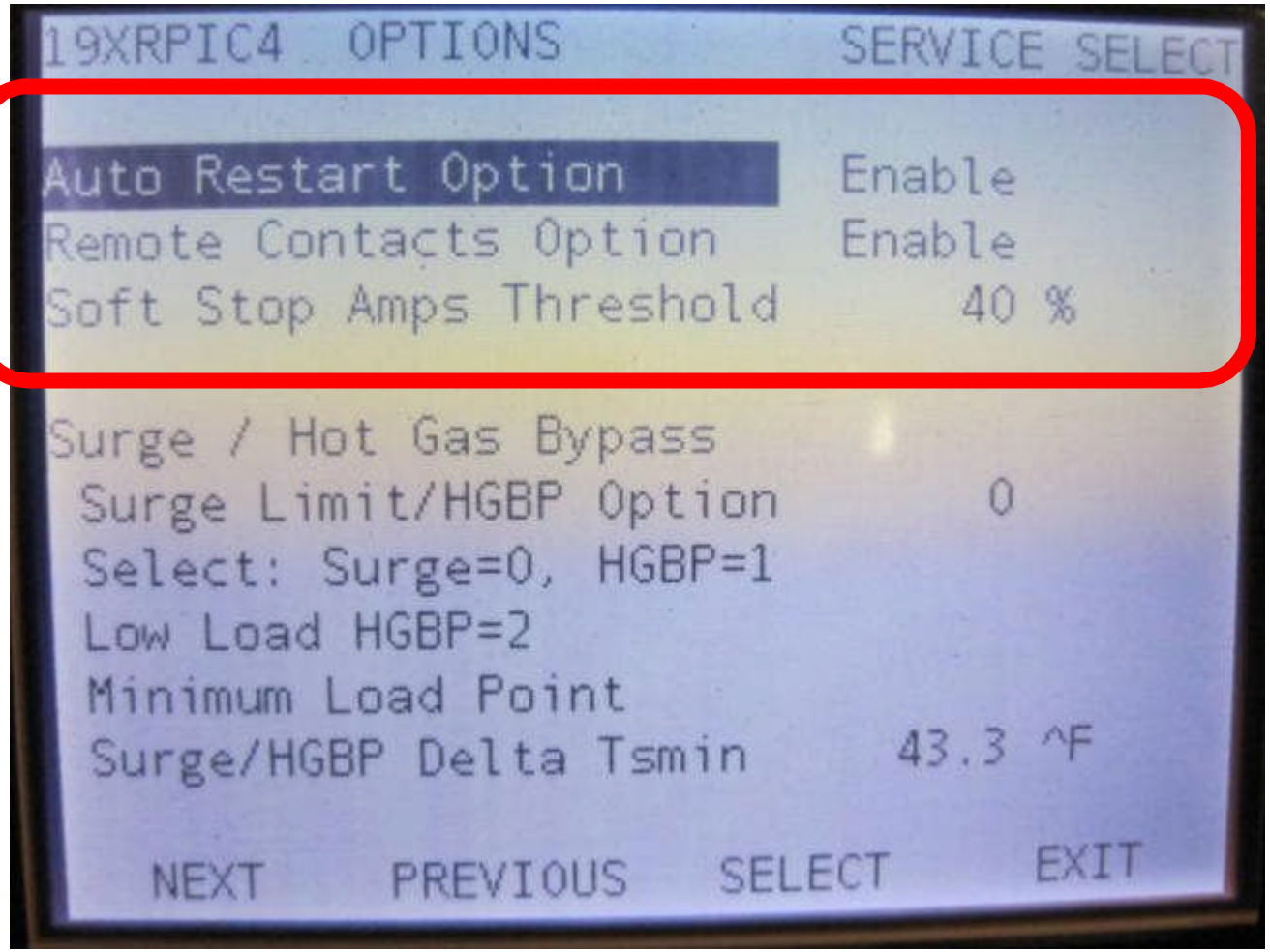


Service Tables:

- OPTIONS
- SETUP1
- SETUP2
- LEADLAG
- RAMP_DEM
- TEMP_CTL

19XRV

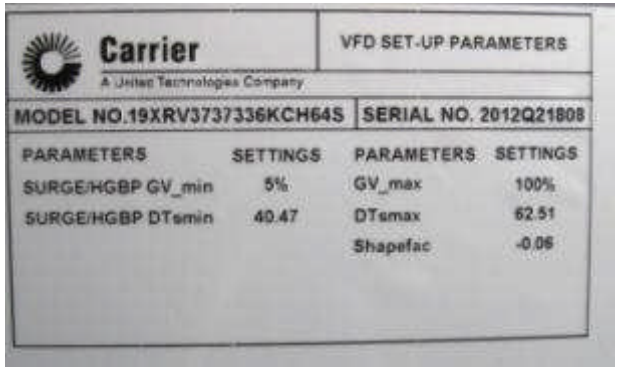
Equipment service → Setup1



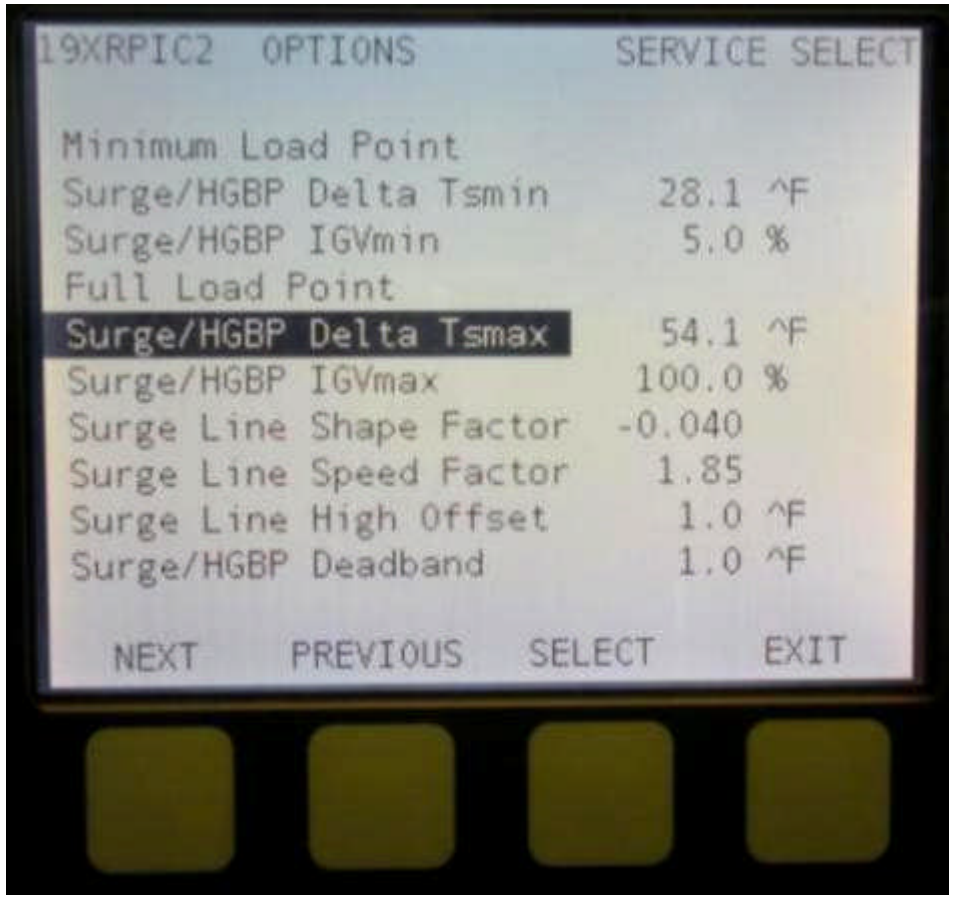
Equipment Service → Options

Carrier
Turn to the Experts

SET SURGE/HGBP Parameters in OPTIONS screen

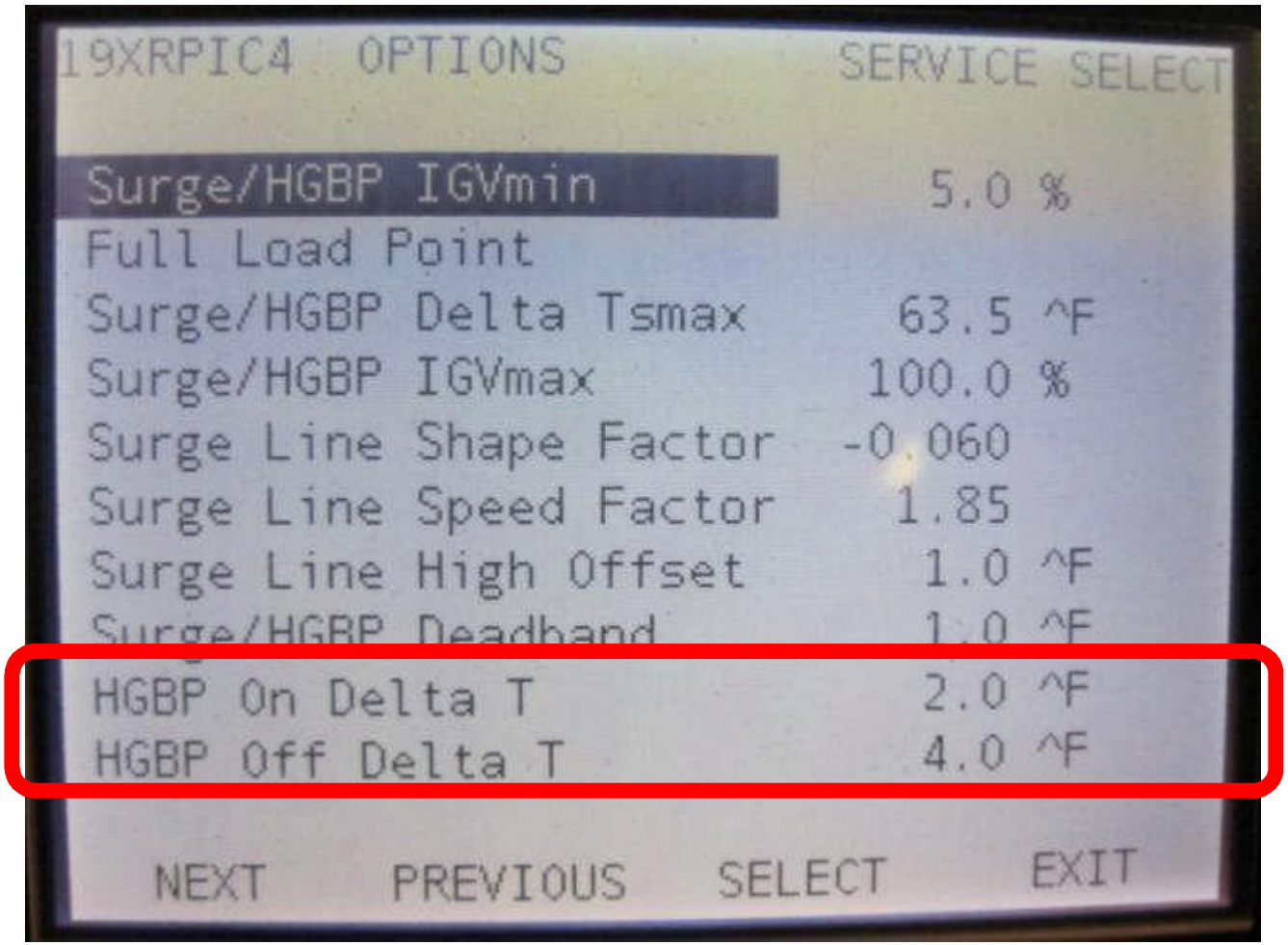


Surge/HGBP Parameter Label located in the Control Panel



Equipment Service → Options

SET HGBP on Delta T on/off if HGBP option is selected for “2-Low load”



On should be set to lowest load chiller can handle based on Chilled water Delta T

Off is offset number for on Delta T

19XRV

Equipment Service → Options

SET HGBP on Delta T on/off if HGBP option is selected for "2-Low load"

Output Type	Full Load	Part Load	Part Load	Part Load	Part Load	Part Load	Part Load	Part Load
Percent Load	100.00	90.00	80.00	70.00	60.00	50.00	40.00	37.00
Chiller Capacity	450.0 Tons	405.0 Tons	360.0 Tons	315.0 Tons	270.0 Tons	225.0 Tons	180.0 Tons	166.5 Tons
Chiller Input kW	267.9 kW	243.5 kW	232.6 kW	218.8 kW	207.9 kW	196.0 kW	179.3 kW	173.5 kW
Chiller Input Power	0.5954 kW/Ton	0.6012 kW/Ton	0.6460 kW/Ton	0.6947 kW/Ton	0.7698 kW/Ton	0.8711 kW/Ton	0.9959 kW/Ton	1.0419 kW/Ton
Chiller COP	5.9	5.9	5.4	5.1	4.6	4.0	3.5	3.4
Cooler								
Entering Temp.	54.00 °F	52.77 °F	51.58 °F	50.38 °F	49.18 °F	47.99 °F	46.79 °F	46.43 °F
Leaving Temp.	42.00 °F	42.00 °F	42.00 °F	42.00 °F	42.00 °F	42.00 °F	42.00 °F	42.00 °F
Flow Rate	898.7 gpm	898.7 gpm	898.7 gpm	898.7 gpm	898.7 gpm	898.7 gpm	898.7 gpm	898.7 gpm
Pressure Drop	15.0 ft wg	15.0 ft wg	15.1 ft wg	15.1 ft wg	15.1 ft wg	15.2 ft wg	15.2 ft wg	15.2 ft wg

OFF **ON**

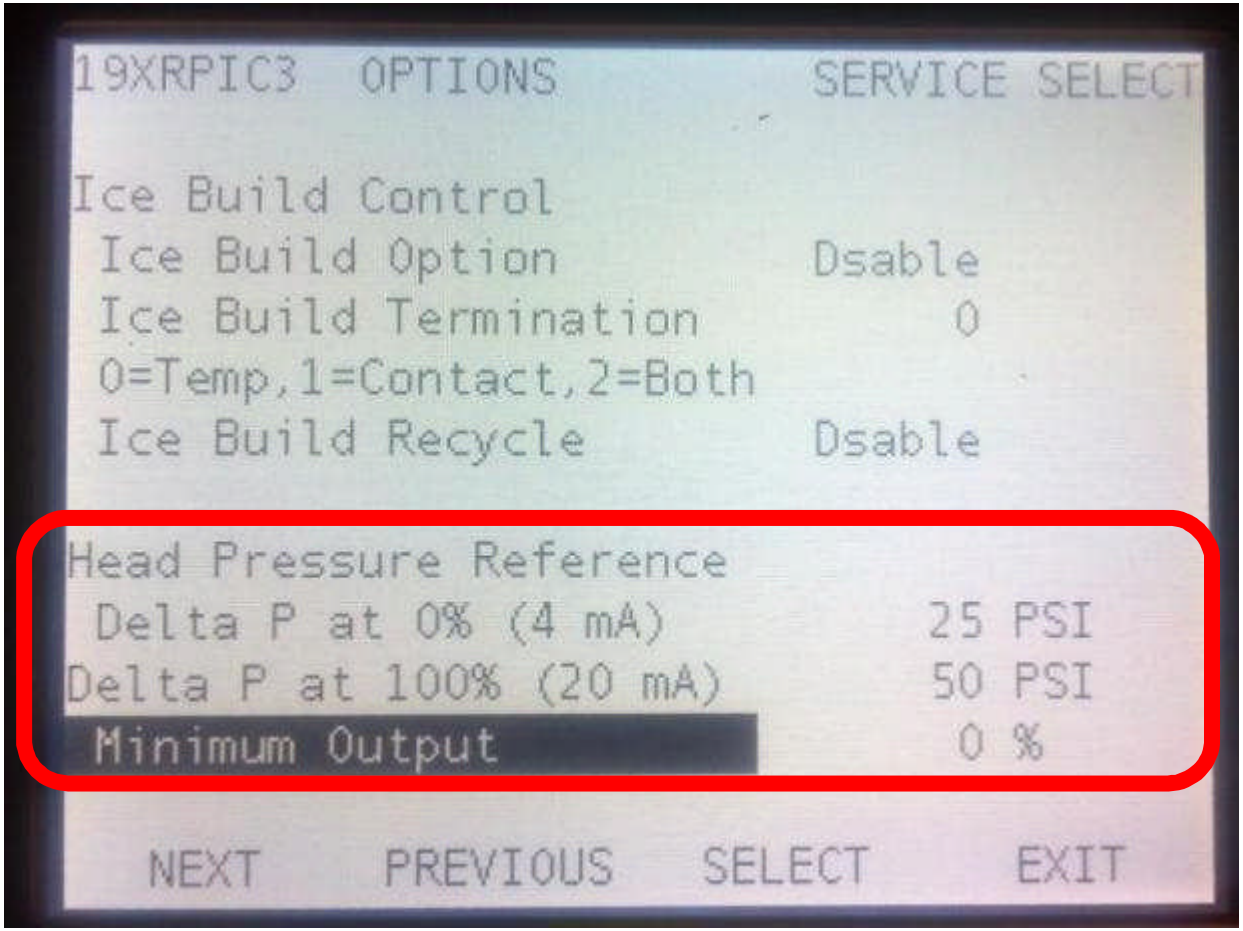
Chiller minimum Delta T prior to surge = 46.4 - 42 = 4.4ºF
HGBP on Delta T should be set above 4.4ºF

If **HGBP off Delta T** is set to 2ºF and HGBP on Delta T is set to 4.5ºF
HGBP will turn off at 4.5+2 = 6.5ºF

19XRV

Equipment service → Options

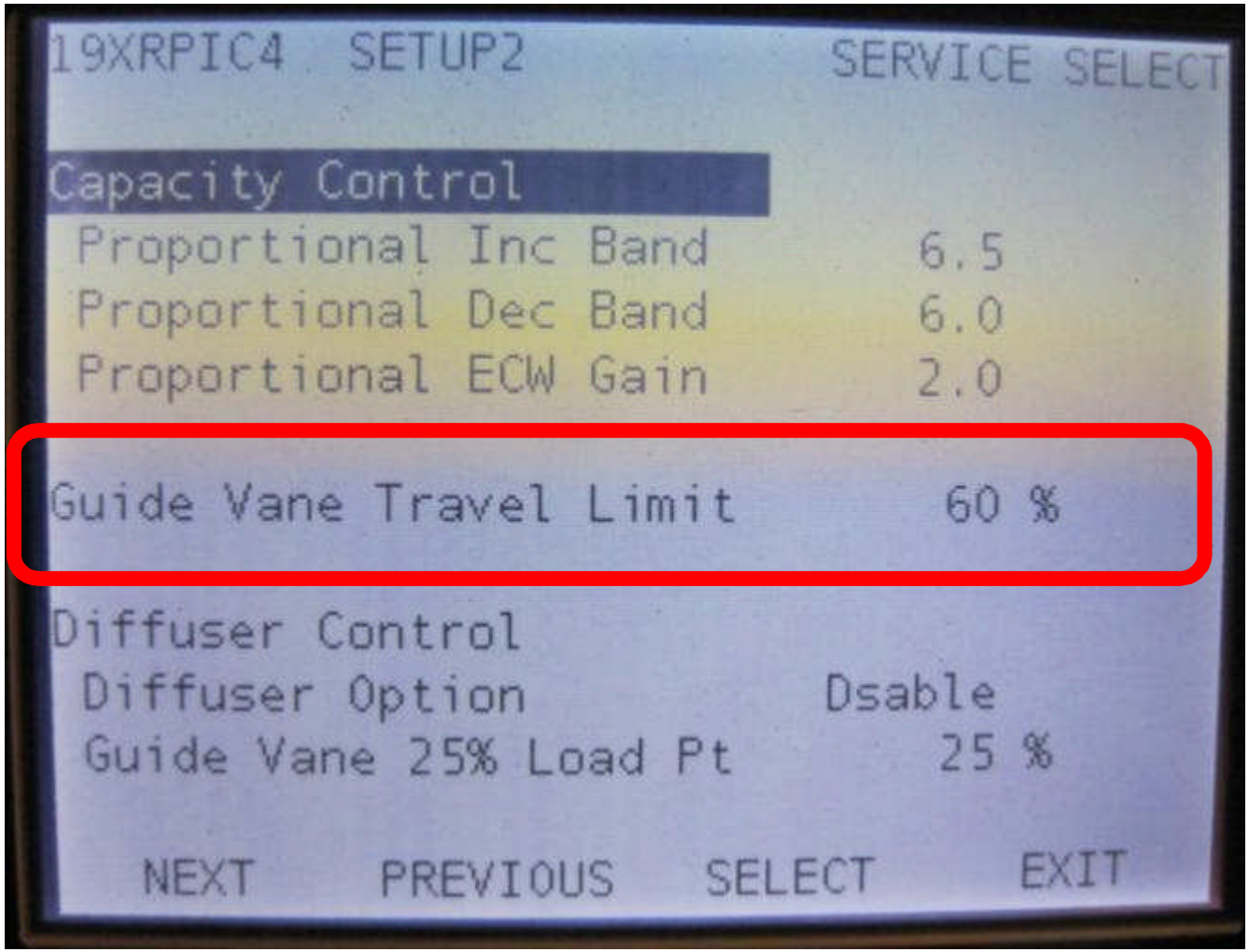
Head Pressure Control



<u>Ideal Settings</u>
4ma = 20psi
20ma = 30~35 psi
Minimum output = 50-100%

19XRV

Equipment service → Setup2
Guide Vane Travel Limit

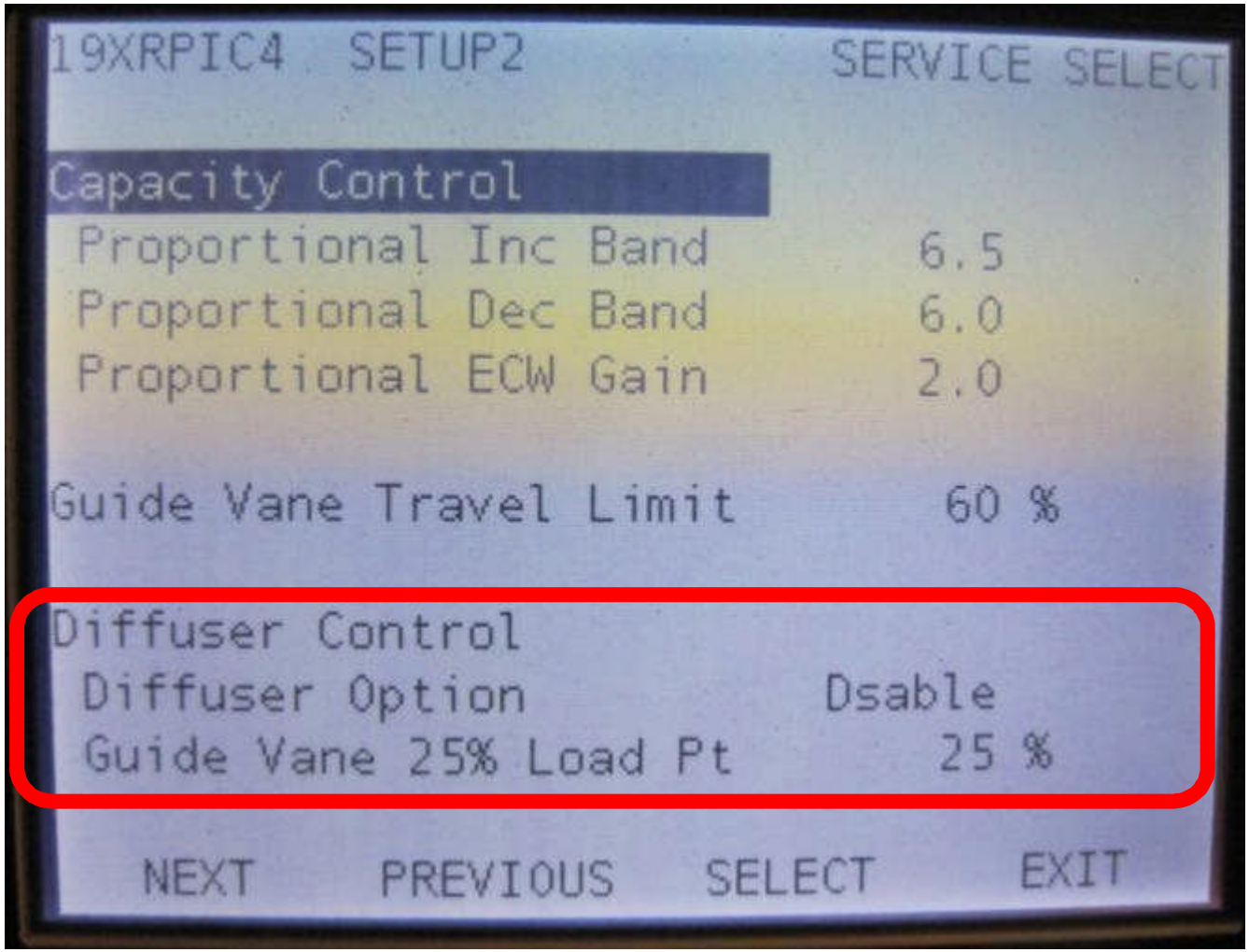


Guide vane travel limit should be set between 60-100%

For chiller with VFD, the preferred travel limit is 60%

19XRV

Equipment service → Setup2
Diffuser Control

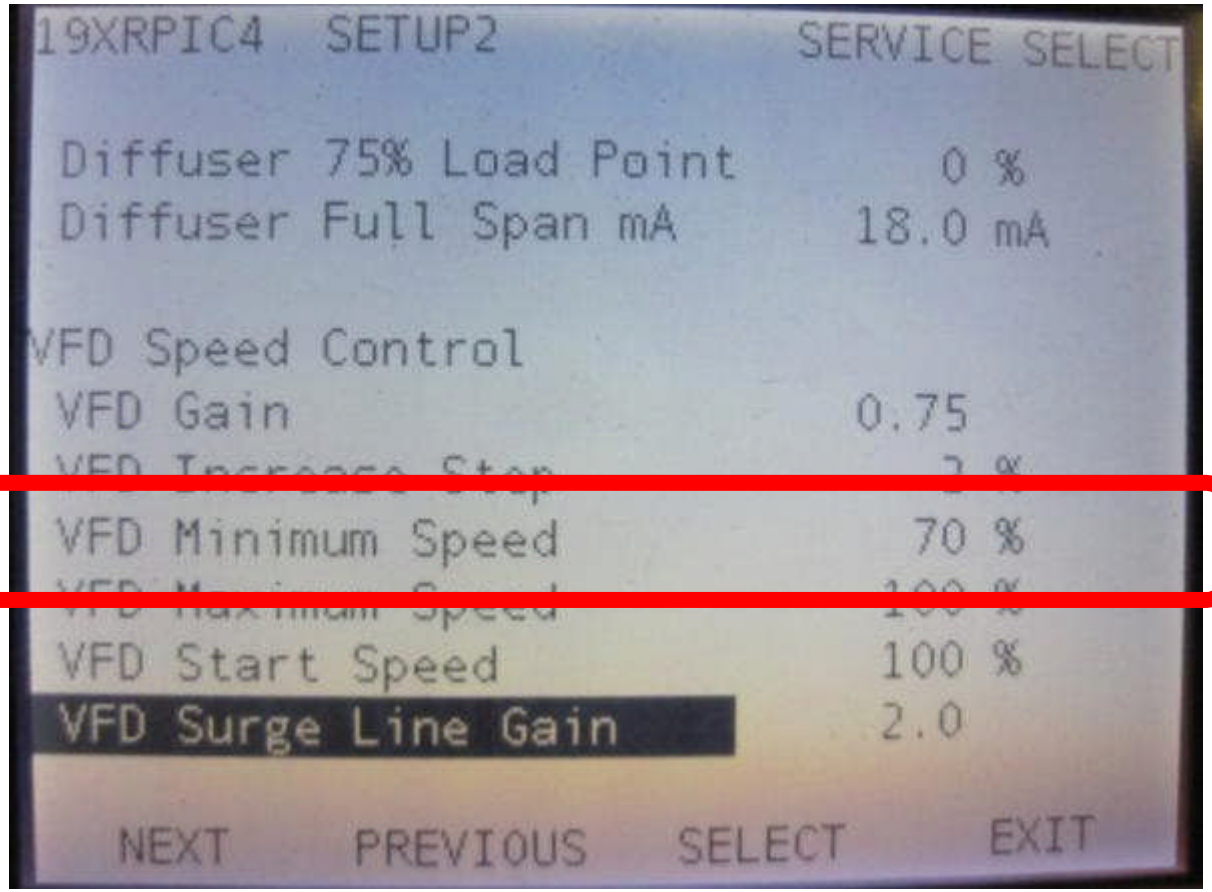


Set Diffuser option to "Enable" for chillers with Split ring diffusers

All Parameters should be programmed per design data

19XRV

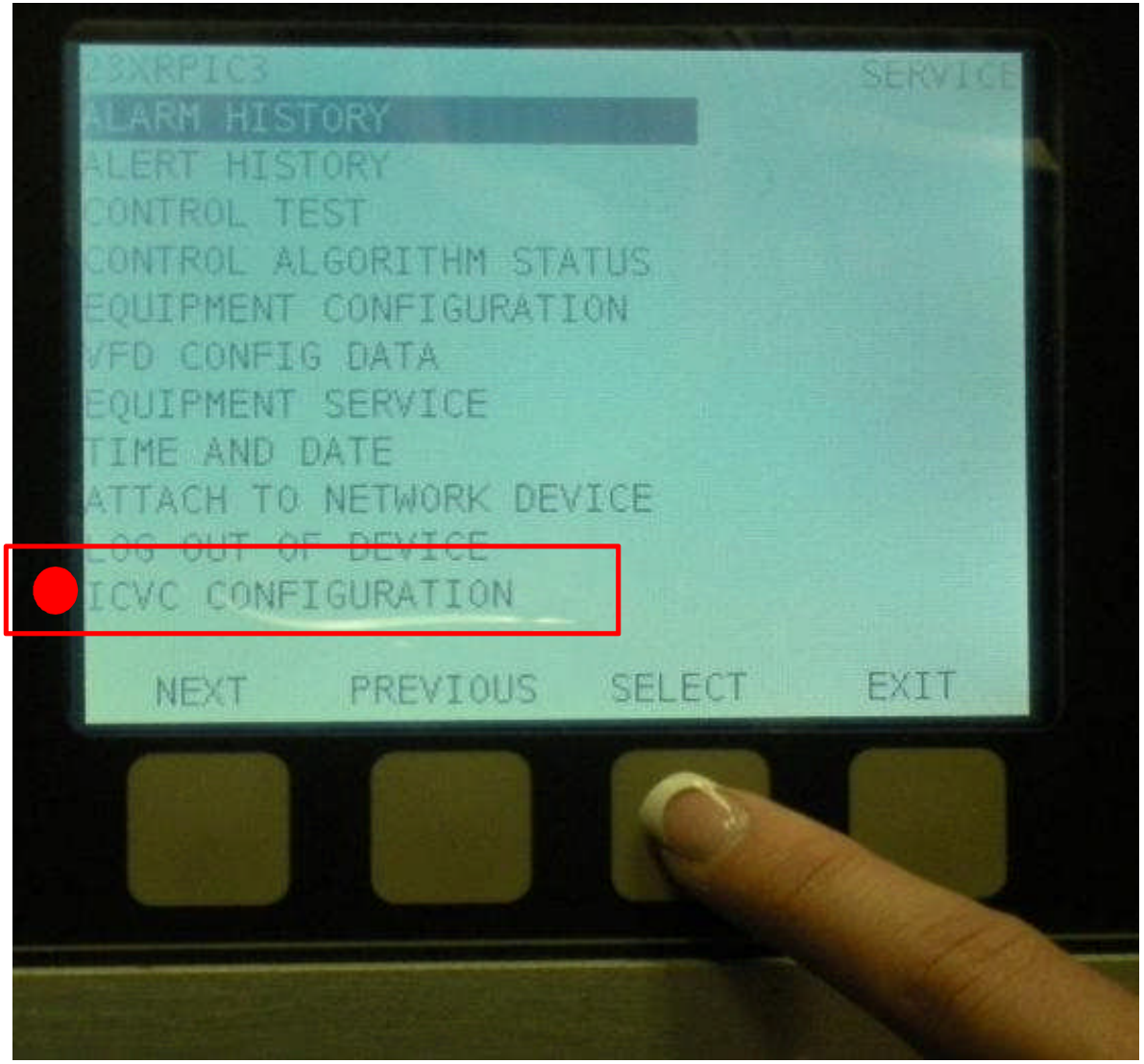
Equipment service → Setup2
VFD Speed Control



Minimum VFD speed MUST NOT be set below 70% (42/60 Hz = 0.7)

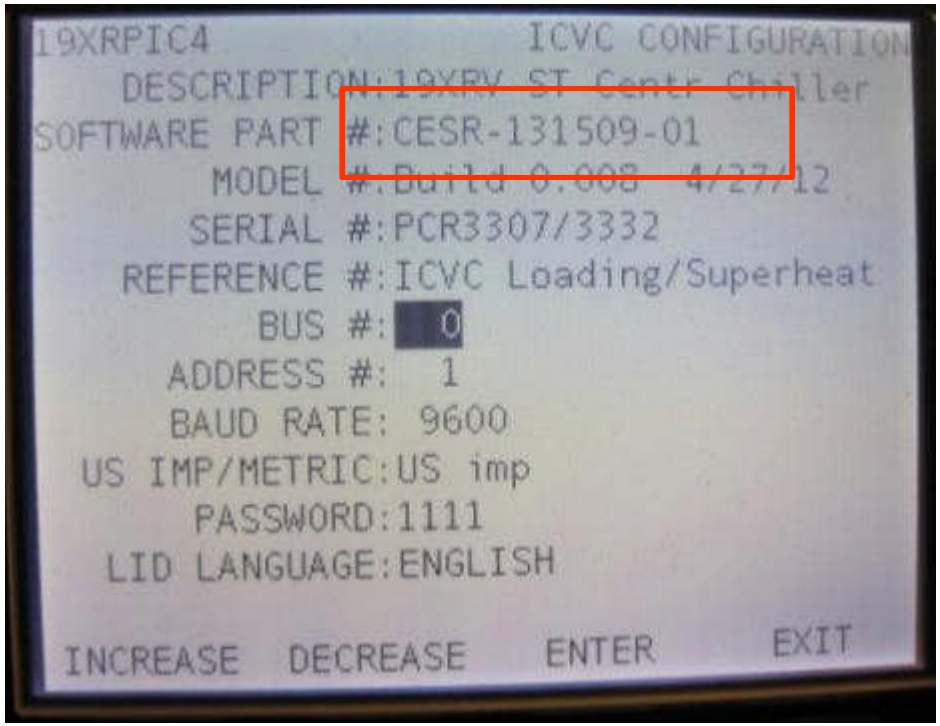
19XRV

PIC III



19XRV

ICVC Sofware



Starter Type	Software #	Latest Version
LF1	131294	10
LF2	131350	4
Std Tier	131509	1
Wye or Solid state starter	131294	10