YORK BY JOHNSON CONTROLS	New Release — Form: 160.82-PW1 (312)
WIRING DIAGRAMS	**UNIT WIRING, FIELD CONNECTIONS, AND FIELD CONTROL MODIFICATIONS**

CONTRACTOR _____	PURCHASER _____
ORDER NO. _____	JOB NAME _____
JCI CONTRACT NO. _____	LOCATION _____
JCI ORDER NO. _____	ENGINEER _____

☐ REFERENCE DATE _____	☐ APPROVAL DATE _____	☐ CONSTRUCTION DATE _____

MODEL CYK CHILLER
WITH LIQUID COOLED SOLID STATE STARTER, OR REMOTE STARTER

JOB DATA:

CHILLER MODEL NO. CYK _____NO. OF UNITS _____

LOW STAGE COMPRESSOR MOTOR _____VOLTS, 3-PHASE, _____ Hz

_____FLA _____LRA _____INRUSH AMPS

HIGH STAGE COMPRESSOR MOTOR _____VOLTS, 3-PHASE, _____ Hz

_____FLA _____LRA _____INRUSH AMPS

VARIABLE SPEED OIL PUMP PANEL _____ VOLTS, 3-PHASE, _____ Hz, _____FLA

Issue Date:
March 19, 2012

IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During installation, operation maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that these individual possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

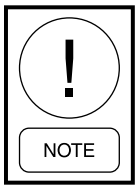
SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to specific situations:

Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.

Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions and are not followed.

Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.



Highlights additional information useful to the technician in completing the work being performed properly.

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls Service office.

Operating/service personnel maintain responsibility for the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, the technician should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the chiller.

CHANGE BARS

Revisions made to this document are indicated with a line along the left or right hand column in the area the revision was made. These revisions are to technical information and any other changes in spelling, grammar or formatting are not included.

ASSOCIATED LITERATURE

MANUAL DESCRIPTION	FORM NUMBER
Unit Operation and Maintenance	160.82-OM1
Renewal Parts	160.82-RP1
Unit Startup Checklist	160.82-CL1

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LIST OF FIGURES

LIST OF TABLES

SECTION 1 - FIELD CONNECTIONS

This document provides detailed information and wiring diagrams to aide customers and/or electrical contractors in the field wiring required for CYK chiller with Quantum Control Center. Instruction notes and diagrams have been written and designed for YORK Remote Starter or Liquid Cooled Solid State Starter. Numbered Field Connection notes references apply to this document only.

Water Pump and Cooling Tower Fan Motor Starter Wiring

Most chilled water plants have multiple chillers connected to common chilled and cooling water headers with the associated water pumps and cooling tower fan motor starters being controlled by an automated plant control system. Therefore, the wiring depicted in this document for those motor starters may not be required.

Low Stage Compressor Motor Starter Wiring

The Low Stage Compressor may be supplied with a remote mounted, floor standing MVSSS or a remote mounted, floor standing MVEMS. The available standard voltage range is 2300VAC-4160VAC. The remote mounted, floor standing MVSSS and MVEMS options require field wiring for all power supply and control interface connections.

Variable Speed Oil Pump Panel Wiring

This panel houses the disconnect switch for the compressor oil pumps, compressor oil heaters, and control power transformer primary power supply. It requires a separate three phase power source in the range of 200VAC-600VAC.

This panel supplies the 120VAC power required for the chiller control panel and other devices on the chiller. The compressor motor starters are supplied with control power transformers to supply the 120VAC required for the internal starter control circuits.

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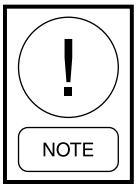
COMMON FIELD CONNECTION NOTES

1. All field wiring shall be in accordance with the current edition of the National Electrical Code (N.E.C.) as well as all other applicable codes and specifications.
2. Terminal board connection points are indicated by numbers within a square i.e. [15]. Main power connection points in motor starters are indicated by numbers within a hexagon i.e. ⟨L1⟩. Component terminal markings are indicated by numbers within a circle i.e. (2). Numbers adjacent to circuit lines are the circuit identification numbers.
3. Terminals L1, L2 and L3 are the main power input terminals and are field connected (see Note 1). Terminals T1, T2 and T3 are the motor load power terminals and are field connected unless otherwise noted.
4. See CYK Wiring Diagram - *Figure 18 on Page 40* for details on the operation of optional flow switches and water pump controls.
5. Compressor motor frame shall be grounded in accordance with the 2008 N.E.C. (Table 250-122) for equipment grounding, using copper conductor only. Motor terminal box is furnished with one 3/8" hex head cap screw and lock washer (ground lug is not furnished) for grounding. Ground the control center with ground screw furnished, using copper conductor only.



For LCSSS and MVSSS there can be NO power factor correction capacitors (PFCC), surge capacitors or lightening arrestors on the motor.

6. Wiring, electrical conduit, junction boxes, fused disconnect switches (FDS) or circuit breakers, starter (M) and manual-off-automatic switch (S) and optional water flow/differential pressure switches furnished by others unless otherwise specified.
7. Items marked (*) furnished by Johnson Controls.
8. Items marked (**) available from Johnson Controls at additional cost.
9. Multiple conduits shall contain an equal number of wires from each phase in each conduit to prevent overheating per 2008 N.E.C. (Paragraph 300- 20(a)). Use copper conductors only; do not use aluminum conductors. Flexible final connections should be used to provide vibration isolation.
10. N/A
11. Wire #14 AWG copper for one way distance of less than 175 feet. Wire #12 AWG copper for one way distance of more than 175 feet, but less than 300 feet.
12. The oil pump motor voltage shall be selected by the customer (see Table 1) at one of the available voltages (200-600 VAC) and wired to a separate supply (FDS1). A 3-pole, 30A fused disconnect or a 3-pole circuit breaker (FDS1) shall be field supplied. Fusing for FDS1 per Table 1 below. Three phase supply must be properly phased: 1LL1 (Phase A), 1LL2 (Phase B), 1LL3 (Phase C).

TABLE 1 - VSOP PANEL POWER SUPPLY

VOLTS-PH-HZ	MINIMUM CIRCUIT AMPACITY	MAXIMUM FUSE SIZE	FLA
200-3-60	29.6	36	27.4
208-3-60	28.3	35	26.2
220-3-60	26.9	33	24.9
230-3-60	25.6	31	23.7
240-3-60	24.5	30	22.7
380-3-60	15.7	19	14.5
416-3-60	14.3	17	13.2
440-3-60	13.3	16	12.3
460-3-60	12.9	16	11.9
480-3-60	12.3	15	11.4
550-3-60	10.6	13	9.8
575-3-60	10.3	12	9.5
600-3-60	9.8	12	9.1
346-3-50	17.1	21	15.8
380-3-50	15.7	19	14.5
400-3-50	14.7	18	13.6
415-3-50	14.3	17	13.2

13. Water box mounted flow switches are installed on all CYK chillers. Chilled and condenser water low flow or differential pressure switches are optional and can be used in place of thermal flow switches.
14. Each 115VAC field-connected inductive load, i.e. relay coil, motor starter coil, etc. shall have a transient suppressor wired (by others) in parallel with its coil, physically located at the coil. Spare transient suppressors are factory supplied inside the Control Center.
15. See *Unit Operation and Maintenance (Form 160.82-OM1)* for field connections required when unit is shipped knocked down (FORM 7).
16. Power Factor Correction Capacitors (PFCC), when utilized, must be sized to meet the N.E.C. and verified through the local YORK/Johnson Controls Office. Improperly installed or sized capacitors may result in equipment malfunction or damage.
    - LCSSS, the PFCC must be installed on the line side of the starter.
    - MVSSS and PFCC can NOT be applied without being switched and must be done as part of the starter purchase order.

LOW VOLTAGE LCSSS FIELD CONNECTION NOTES

17. The control power transformer on the side of the starter enclosure is used for the 120VAC power required by the YORK Style B LCSSS only. It is not used for the chiller control panel and other devices on the chiller.

18. Solid State Starter shall be grounded in accordance with the 2008 N.E.C. (Paragraph 250-118) for equipment grounding. Flexible conduit is required for final connection to the starter. When a separate grounding conductor is required, it must be a copper conductor only and sized per the 2008 N.E.C. (Table 250- 122). Per 2008 N.E.C. [Paragraph 250-122 (F)], where multiple (parallel) conduits are used each must contain a grounding conductor. See Note 8 for grounding lug wire range.

19. Flexible conduit must be used for final connections to starter. Multiple conduits shall contain an equal number of wires from each phase in each conduit to prevent overheating per 2008 N.E.C. (Paragraph 300-20 (A)). Use copper conductors only; DO NOT USE aluminum conductors. See Note 20 for factory furnished starter terminal lug wire ranges and conduit connection provisions.

STARTER MODEL NUMBER	(NO. OF CONDUITS) MAX. CONDUIT SIZE
7LK, 14LK	(2) 3”
26LK, 33LK	(4) 3”

Remove plate on top of enclosure and cut holes to suit.

20. The following terminal lugs are factory furnished for field wiring connections when a factory-installed disconnect switch or circuit breaker is not supplied. All lugs are rated AL9CU.

STARTER MODEL NO. WITHOUT DISCONNECT/ CIRCUIT BREAKER OPTION	LINE SIDE LUGS		GROUNDING LUG, WIRE RANGE, QUANTITY AL9CU
	QUANTITY PER TERMINAL	WIRE RANGE	
SSS 7LK	1	#4-600 kcmil	#14-1/0, One bbl.
SSS 14LK	2	#2-600 kcmil	#14-1/0, One bbl.
SSS 26LK	3	#2-600 kcmil	#4-600 kcmil, Two bbl. or 1/0-250 kcmil, Four bl.
SSS 33LK	4	#2-600 kcmil	

The following terminal lugs are factory furnished for field wiring connections when a factory-installed disconnect switch or circuit breaker with ground fault protection is supplied.

STARTER MODEL NO. & AVAILABLE DISCONNECT SWITCH/CIRCUIT BREAKER AMP RATING (SEE NOTE 21a)	LINE SIDE LUGS			GROUNDING LUG, WIRE RANGE, QUANTITY AL9CU
	QTY. PER TERMINAL	WIRE RANGE	LUG RATING	
SSS 7LK, 250A	1	#6-350 kcmil	AL7CU	#14-1/10, One bbl.
SSS 7LK, 400A	2	3/0-250 kcmil	AL7CU	
SSS 14LK, 400A	2	3/0-250 kcmil	AL7CU	#14-1/10, T wo bbl.
SSS 14LK, 600A	2	250-500 kcmil	AL9CU	
SSS 26LK, 1000A/1200A	4	4/0-500 kcmil	AL9CU	#4-600 kcmil, Two bbl. or 1/0-250 kcmil, Four bbl.
SSS 33LK, 1200A	4	4/0-500 kcmil	AL9CU	

21. Full load amperes for the 2.0 KVA control power transformer (furnished by YORK and factory wired) to be used with Notes 22, 23 and 24.

22. If an optional circuit breaker is not provided, the branch circuit overcurrent protection device(s) for the YORK Style B LCSSS must be a time delay type with a rating which is sized in accordance with the N.E.C., and shall not exceed the smaller of the two ratings listed below, (a) or (b):

    a. The next standard fuse/breaker rating below: 2.25 (Compressor Motor FLA) + Control Transformer Amps

    b. A rating limited by the starter size as follows:

STARTER MODEL NUMBER	MAX. FUSE/BREAKER SIZE (AMPS)
SSS 7LK	500
SSS 14LK	1000
SSS 26LK	1600
SSS 33LK	2000

Where 2.25 factor is per 2008 N.E.C. (Para. 440-22 (A) and (B); FLA is per Note 7; control power transformer Amps per Note 21.

23. The YORK Style B LCSSS power wiring ampacity shall be calculated as follows.

    Model CYK minimum Circuit ampacity:

    Ampacity = 1.25 (compressor Motor FLA) + Control Transformer Amps, where 125% factor is per 2008 N.E.C. (para. 440-33); FLA is per page 1 of this document; Control Transformer Amps per Note 21.

24. The short-circuit withstand capacity, as described in UL Standard 508, in symmetrical RMS current is listed in the following table for each of the field wiring option kits:

MODEL	OPTION KIT	KA RATING (SYMETRICAL 1, RMS)	
		480V MAX	600V MAX
SSS7L	Lug 250A Disconnect Switch 400A Disconnect Switch	18	18
	250A Circuit Breaker 400A Circuit Breaker	65	22
SSS14L	Lug 250A Disconnect Switch 400A Disconnect Switch 600A Disconnect Switch	30	30 22 22 30
	250A Circuit Breaker 400A Circuit Breaker 600A Circuit Breaker	65	22 22 35
SSS26L	Lug 1200A Disconnect Switch	42	42
	1000A Circuit Breaker	65	50
SSS33L	Lug 1200A Circuit Breaker	42 65	42 50

25. If the fused disconnect switch (FDS2) is not located in sight (2008 N.E.C. Para. 440-14) of the YORK Style B LCSSS, a non-fused disconnect switch (not shown) shall be located in sight of the Solid State Starter; between FDS2 and Solid State Starter. The ampere rating shall be determined as follows for the disconnect switch of FDS2: The larger of

    a. Amp Rating = 1.15 (Compressor Motor FLA+ Control Transformer Amps)

    – or –

    b. The size required to mount the fuses determined in Note 15 (if a fused disconnect is employed).

    c. Where 115% factor is per 2008 N.E.C. (Para. 440- 12B (2)); FLA is per page 1 of this document; control power transformer Amps per Note 21. An optional factory mounted and wired disconnect switch within the YORK Style B LCSSS is available (See Note 20).

26. The main power transformer should be adequately sized such that the transformer voltage drop does not exceed 10% during unit start-up. The supply voltage (at starter input terminals) during start-up, must be maintained above the minimum value specified in the table. Note that while the YORK chiller will perform acceptably during startup with this amount of voltage drop, the performance of other equipment connected to the supply transformer could be adversely affected.

THREE PHASE VOLTAGE	Hz	MINIMUM VOLTAGE AT STARTER INPUT TERMINALS DURING START-UP
200/208	60	160
220/230/240	60	185
440/460/480	60	370
550/575/600	60	460
380	50/60	305
400	50	320
415	50	335

27. N/A

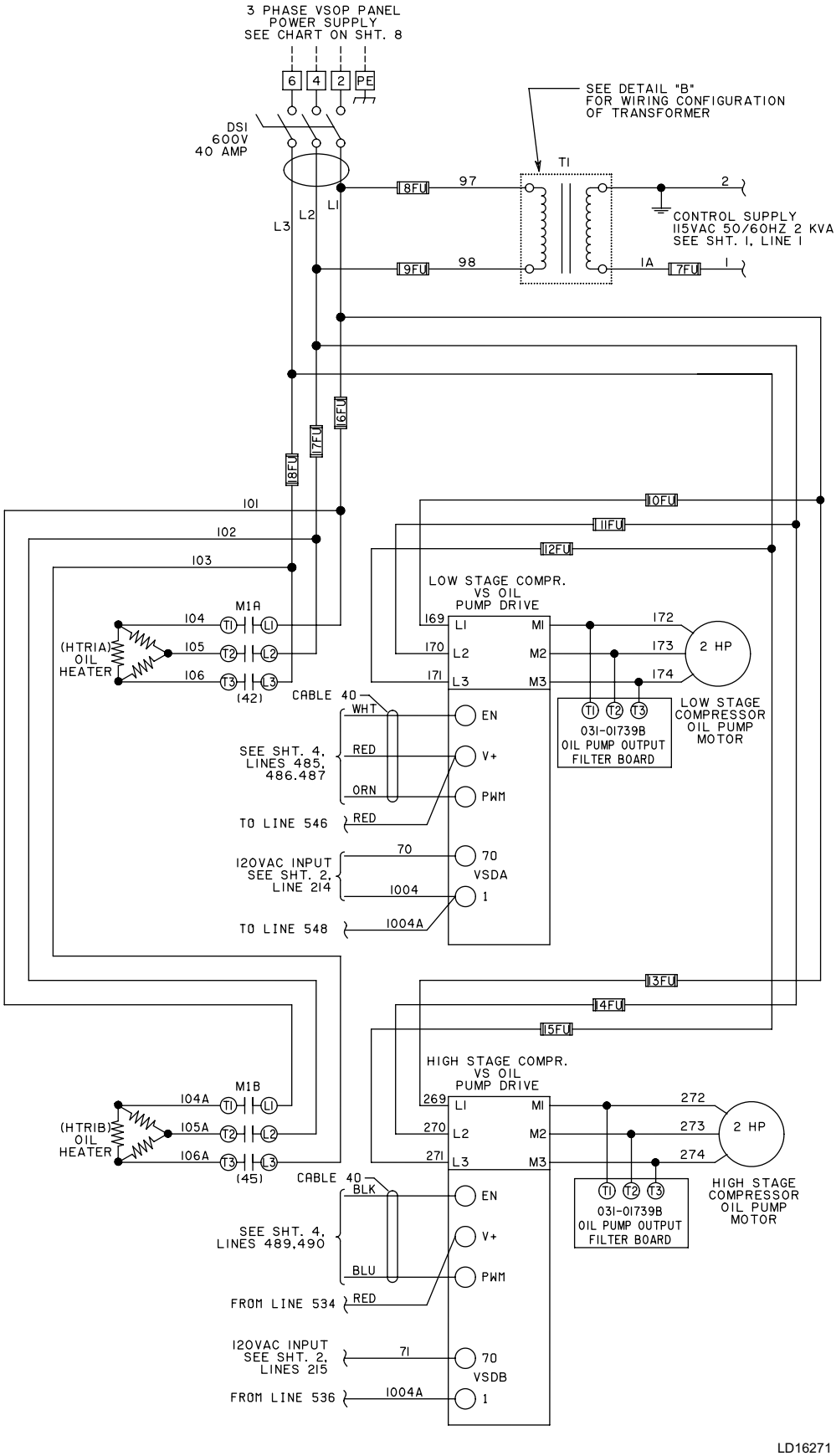


FIGURE 1 - FIELD CONNECTIONS FOR COMPRESSOR VSOP PANEL

LOW OR MEDIUM VOLTAGE SSS FIELD CONNECTION NOTES

28. The control power transformer located inside the starter enclosure is used for the 120VAC power required by the MVSSS only. It is not used for the chiller control panel and other devices on the chiller.

29. MVSSS and Compressor motor frame shall be grounded in accordance with 2008 N.E.C. (Paragraph 250-118) for equipment grounding. When a separate grounding conductor is required, it must be a copper conductor only and sized per the 2008 N.E.C. (Table 250-122). Per 2008 N.E.C. [paragraph 250-122 (F)], where multiple (parallel) conduits are used each must contain a grounding conductor.

30. Multiple conduits shall contain an equal number of wires from each phase in each conduit to prevent overheating per 2008 N.E.C. (Paragraph 300-20 (A)). Use copper conductors only; DO NOT USE aluminum conductors. Flexible final connections to the compressor motor should be used to provide vibration isolation.

31. Power wiring connections are shown in the Service manual for the MVSSS. Power wiring lugs are field supplied.

32. The following interconnecting wires are field supplied when a YORK MVSSS is used.

    120 VAC - control interface wire; single conductor, stranded, 14-18 awg, 600v, 75- 90˚C, THWN or UL style 1015, UL listed and CSA approved, insulation shall be moisture resistant thermoplastic (PVC).

33. The YORK MVSSS starters (2300 to 4160 volts) have high interrupting capacity current limiting fuses plus an integral non-load disconnect function and thus do not require the use of FDS3, provided the MVSSS is placed in sight of the chiller. If the FDS3 is required, minimum ampere rating shall be 1.15X (compressor motor amps + 1 AMP (MVSSS internal controls)).

34. The YORK MVSSS input power wiring ampacity shall be calculated as follows.

    Model CYK minimum circuit ampacity:

    Ampacity = 1.25X (Compressor Motor FLA) + 1 Amp (MVSSS internal controls), where 125% factor is per 2008 N.E.C. Para. 440-33); FLA is per page 1 of this document.

35. Medium voltage (2300 volts to 4160 volts) motors have three leads. Motor leads are furnished with a crimp type connector having a clearance hole for a 3/8” bolt. Motor terminal lugs are not supplied.

36. Starter to motor power wiring ampacity shall be calculated as follows:

    Minimum circuit ampacity per conductor (one of three):

    d. Ampacity = 1.25 x compressor motor amps.

    e. Where 125% factor is per 2008 NEC (para 440-33).

    f. Compressor Motor Amps (per page 1 of this document) are FLA.

37. The interrupting capacity of the YORK MVSSS is 50 KA RMS symmetrical amperes at the nameplate voltage. The YORK MVSSS is suitable for use on a circuit capable of delivering not more than 50KA RMS symmetrical amperes at the nameplate voltage.

38. The main power transformer should be adequately sized such that the transformer voltage drop does not exceed 10% during unit start-up. The supply voltage (at starter input terminals) during start-up, must be maintained above the minimum value specified in the table below. Note that while the YORK chiller will perform acceptably during startup with this amount of voltage drop, the performance of other equipment connected to the supply transformer could be adversely affected.

3-PHASE VOLTAGE	Hz	MINIMUM VOLTAGE AT STARTER INPUT TERMINALS DURING START-UP
4160	60	3536
2300	60	1955
3300	50	2805

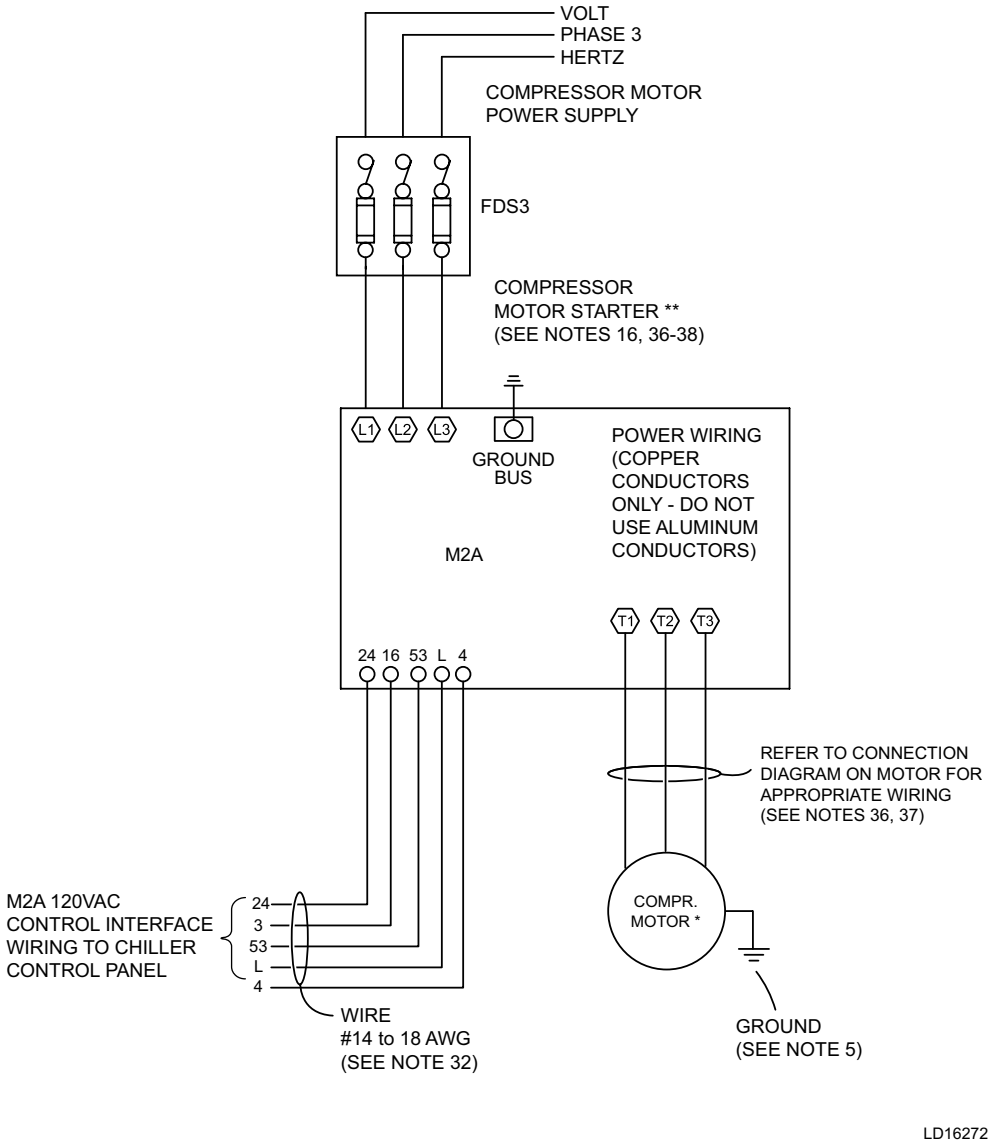


FIGURE 2 - FIELD CONNECTIONS FOR M2A REMOTE STARTER LOW STAGE

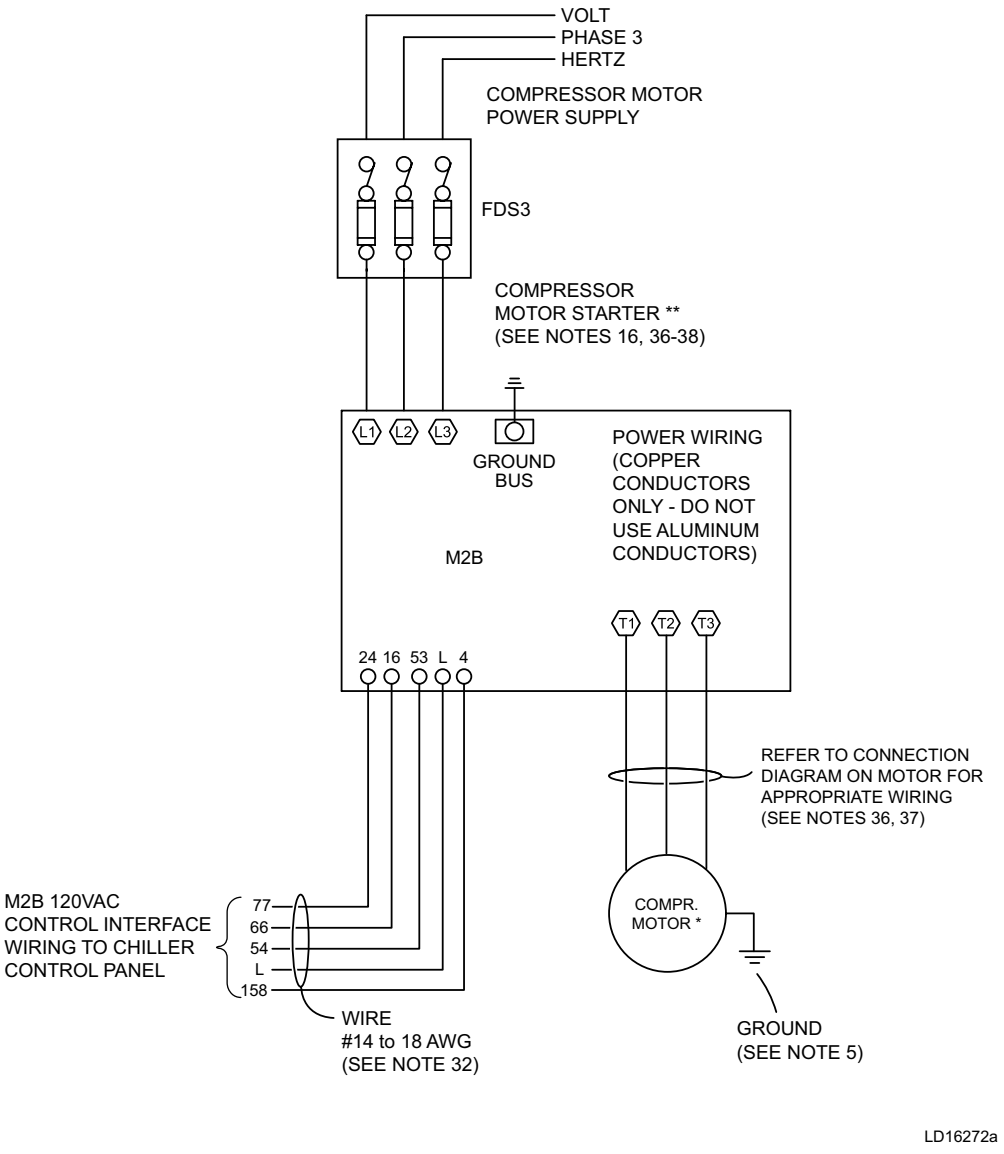


FIGURE 3 - FIELD CONNECTIONS FOR M2B REMOTE STARTER HIGH STAGE

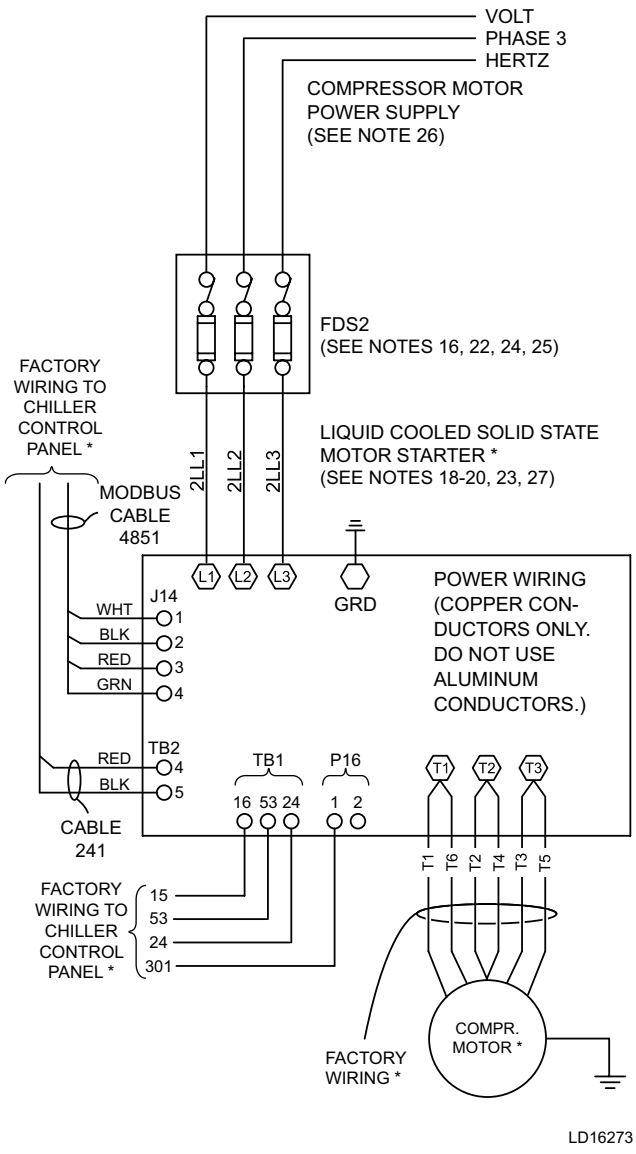


FIGURE 4 - FIELD CONNECTIONS FOR LCSSS LOW STAGE

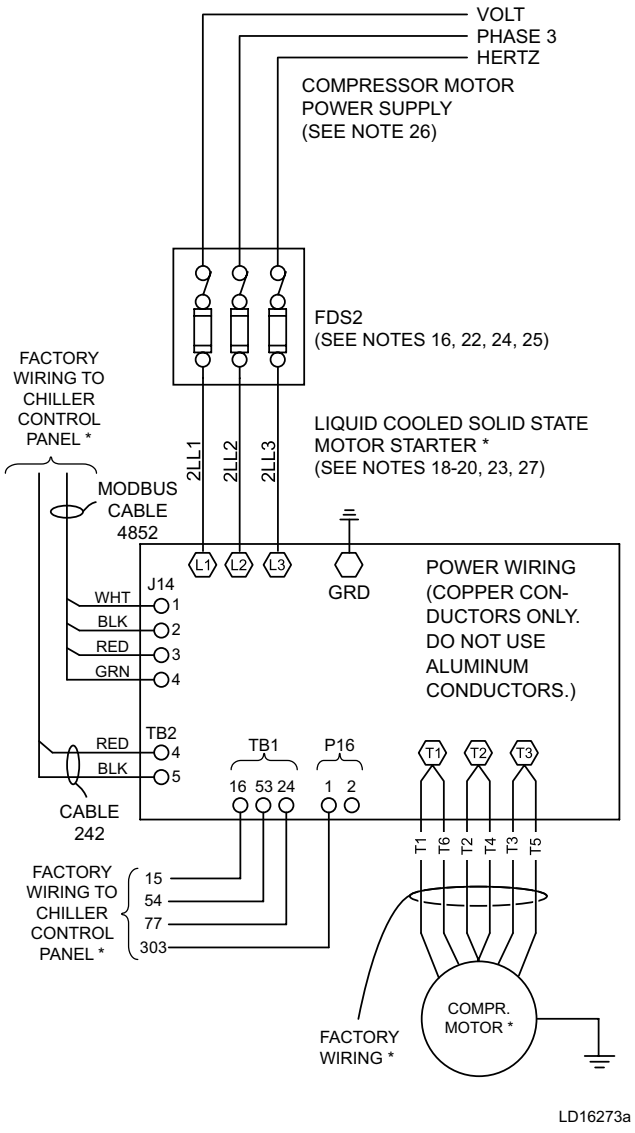


FIGURE 5 - FIELD CONNECTIONS FOR LCSSS HIGH STAGE

SECTION 2 - UNIT WIRING

1. All wiring shall be in accordance with the national electric code as well as all other applicable codes and specifications.
2. An underlined contact location signifies a normally closed contact. Numbers within parenthesis (beneath contacts) indicate line number location of relay or timer coil.
3. Numbers adjacent to circuit lines are the circuit identification.
4. Both compressor starter motors may be supplied with a starter which complies with specification R-1177. Run interlock is only used on remote mounted starter. All interface wiring for the remote mounted starters is supplied and installed by others.
5. Ground control panel cabinet.
6. Identify all control panel wiring using heat shrinkable type wire markers.
7. Use appropriate wire size depending on AMP rating of circuit breaker protecting the conductor: Derated for 50 degree C/122 degree F using YORK/Johnson Controls C-10 standard.

   30 AMPS - #10 AWG
   20 AMPS - #12 AWG
   15 AMPS - #14 AWG
   10 AMPS - #16 AWG

   All wire material must be per YORK/Johnson Controls C-10 standard. Unless otherwise noted all panel wiring to be 16 AWG. Unless otherwise noted wire color coding to be as follows:

   115 VAC Hot - Black
   115 VAC Neutral - White
   +/- 5 VDC - Dark Blue
   +/- 24 VDC - Dark Blue
   Ground - Green/Yellow
   3 Phase - Black

   Field wiring must be sized by the installing contractor using appropriate derating factors for ambient conditions and number of conductors in conduit as required by 2008 NEC article 310.
8. Three phase oil pump must be properly phased. IL1, IL2 and IL3 corresponding to phase sequence A, B and C.
9. A coil transient suppressor must be installed on every coil or inductive load connected to the 129 VAC output module unless otherwise noted. Suppressors are supplied with control panel for field installation if needed.
10. Install 1 each flow sensor in each of the heat exchanger's outlet nozzle. Use the 1/2" coupling best suited for sensor installation.
11. Secure conduits and cables together with cable straps.
12. Provide “Drip Loops” to 120 volt or greater wire harnesses to prevent water from entering junction boxes, panels, etc.
13. Assemble wires to existing harness in panel and solid state starter with Item 61.
14. Pack insulation into motor terminal box after connection of motor leads.

ELEMENTARY DIAGRAM FOR REMOTE STARTER

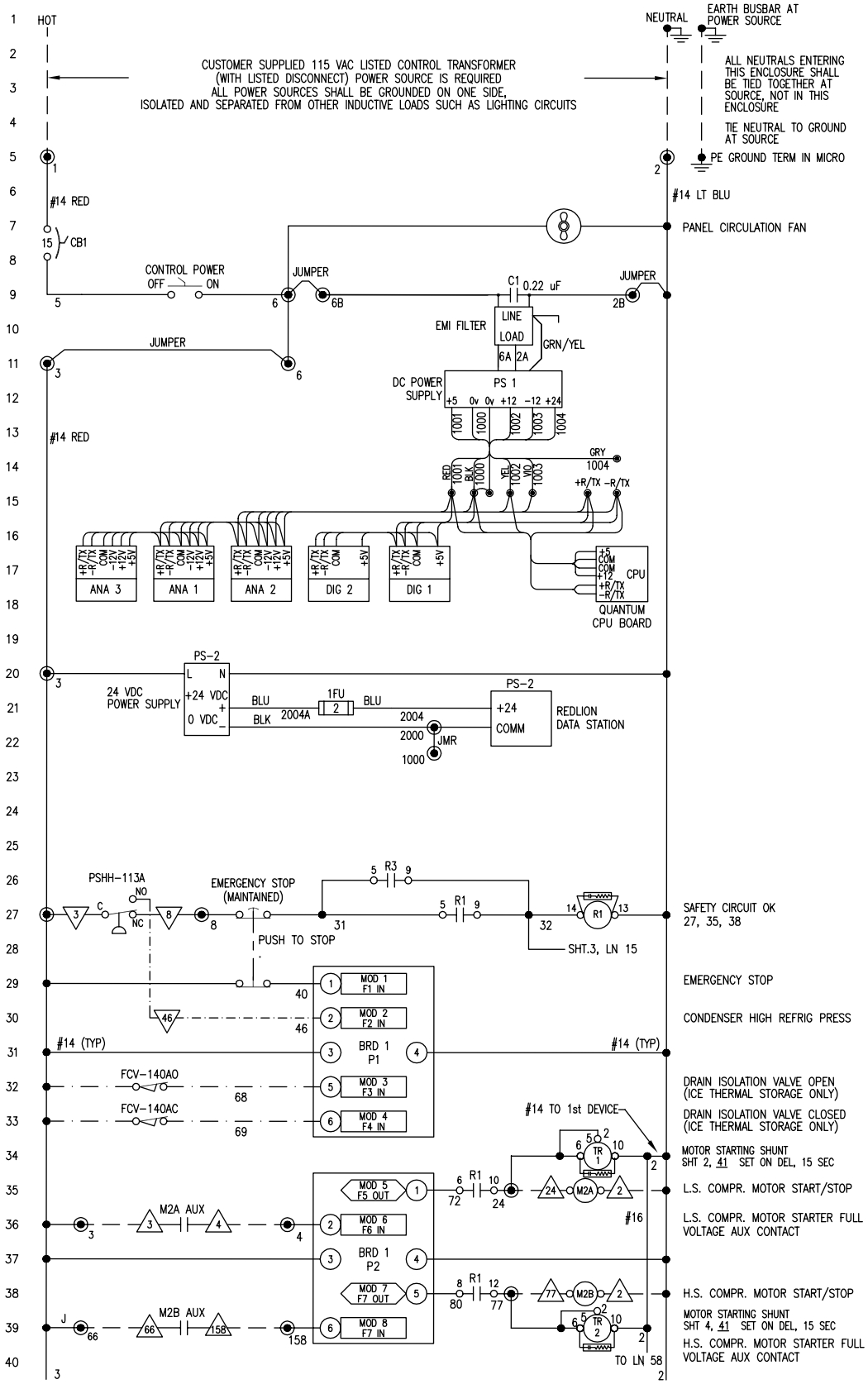


FIGURE 6 - ELEMENTARY DIAGRAM FOR REMOTE STARTER

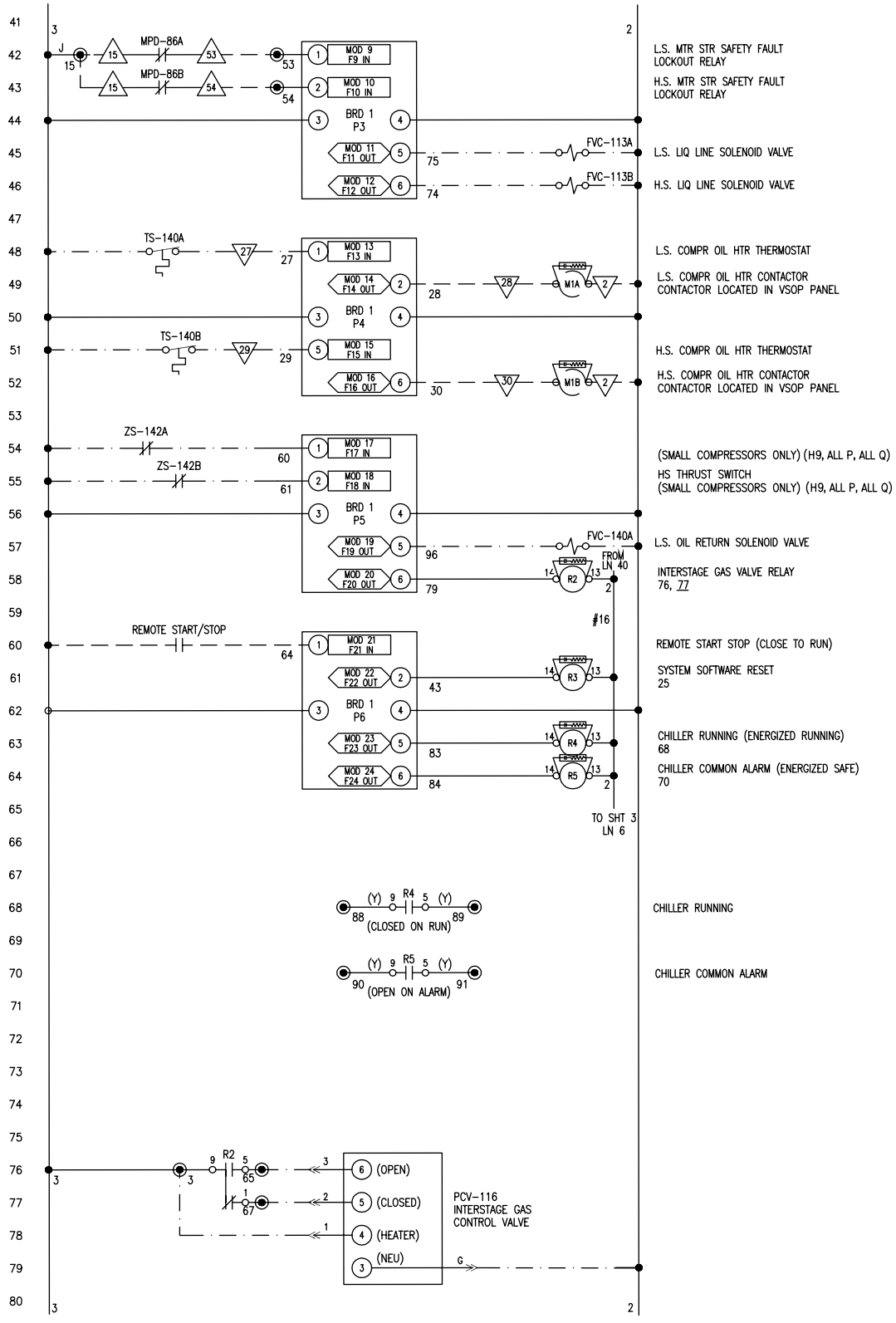


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FIGURE 6 - ELEMENTARY DIAGRAM FOR REMOTE STARTER (CONT'D)

ANALOG BOARD 1 FOR REMOTE STARTER

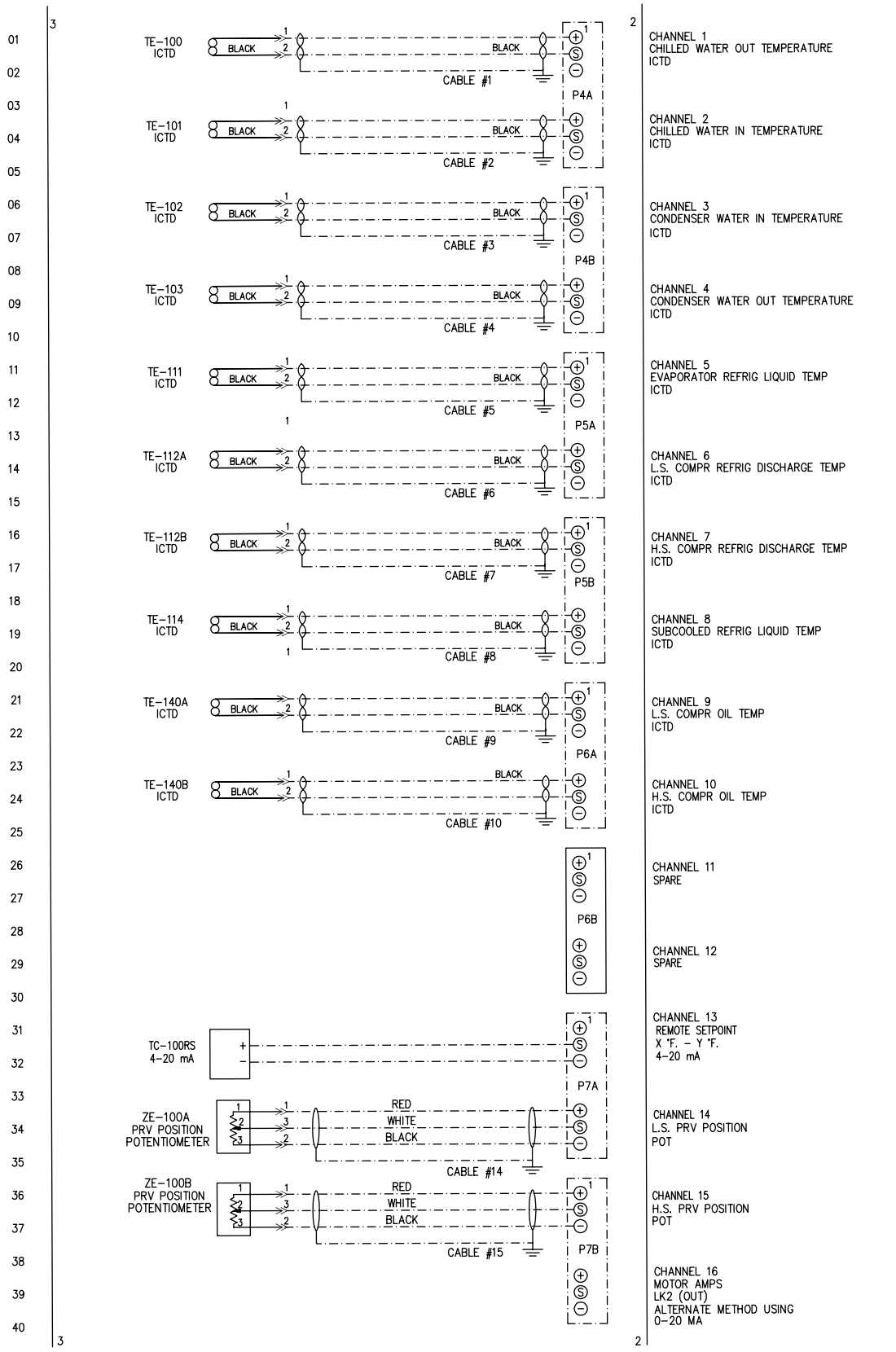

FIGURE 7 - ANALOG BOARD 1 FOR REMOTE STARTER

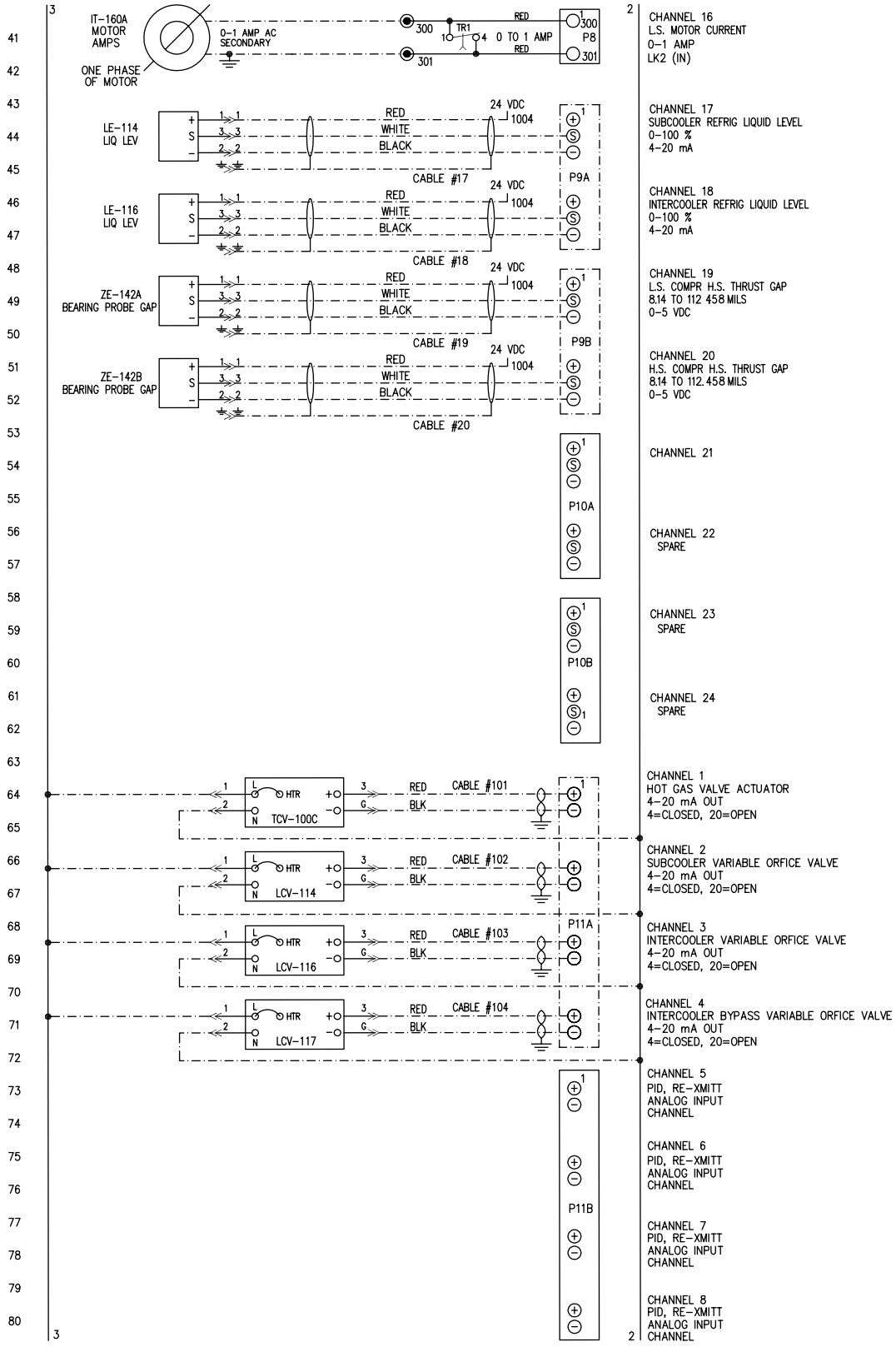

FIGURE 7 - ANALOG BOARD 1 FOR REMOTE STARTER (CONT'D)

DIGITAL BOARD 2 FOR REMOTE STARTER

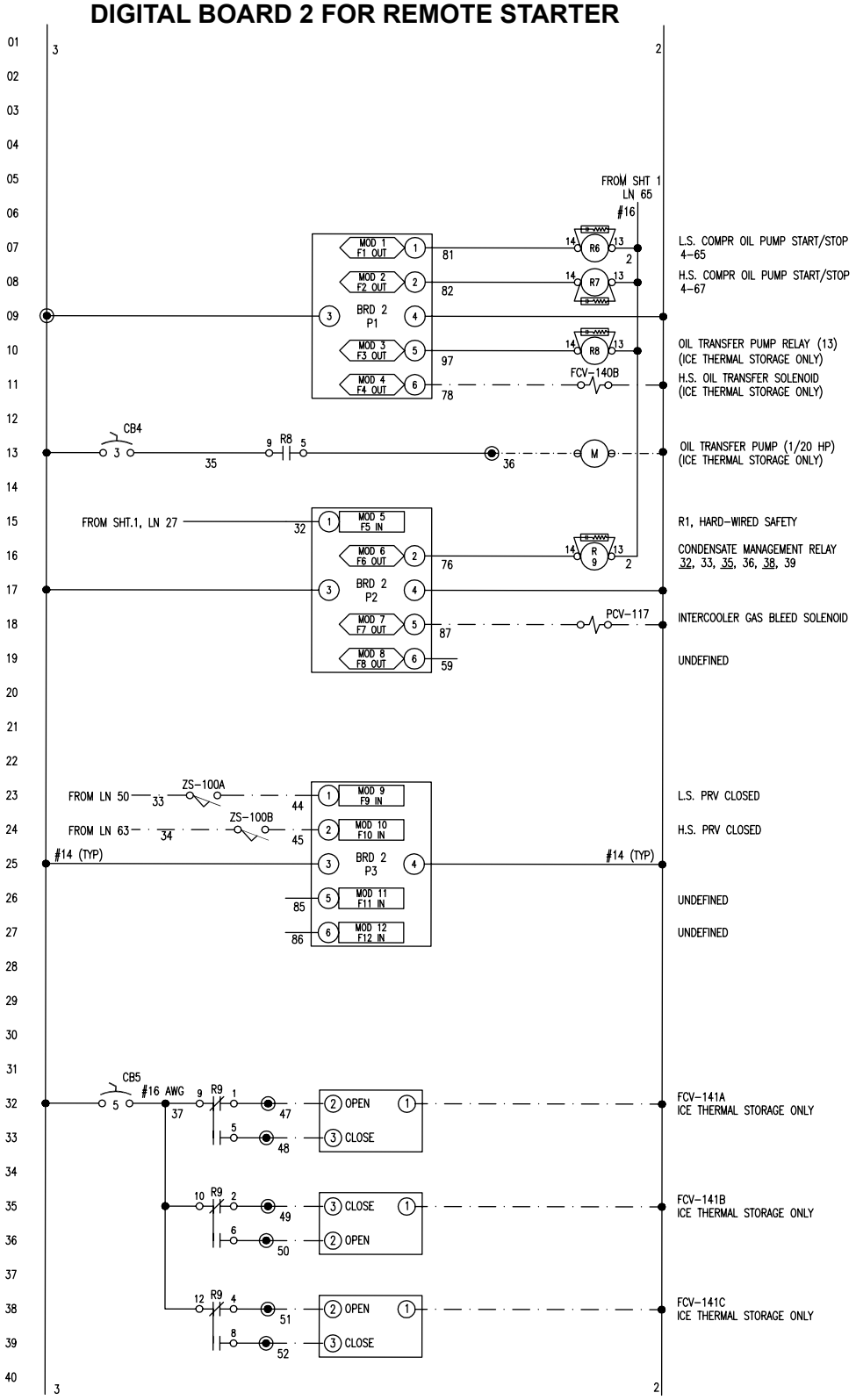

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FIGURE 8 - DIGITAL BOARD 2 FOR REMOTE STARTER

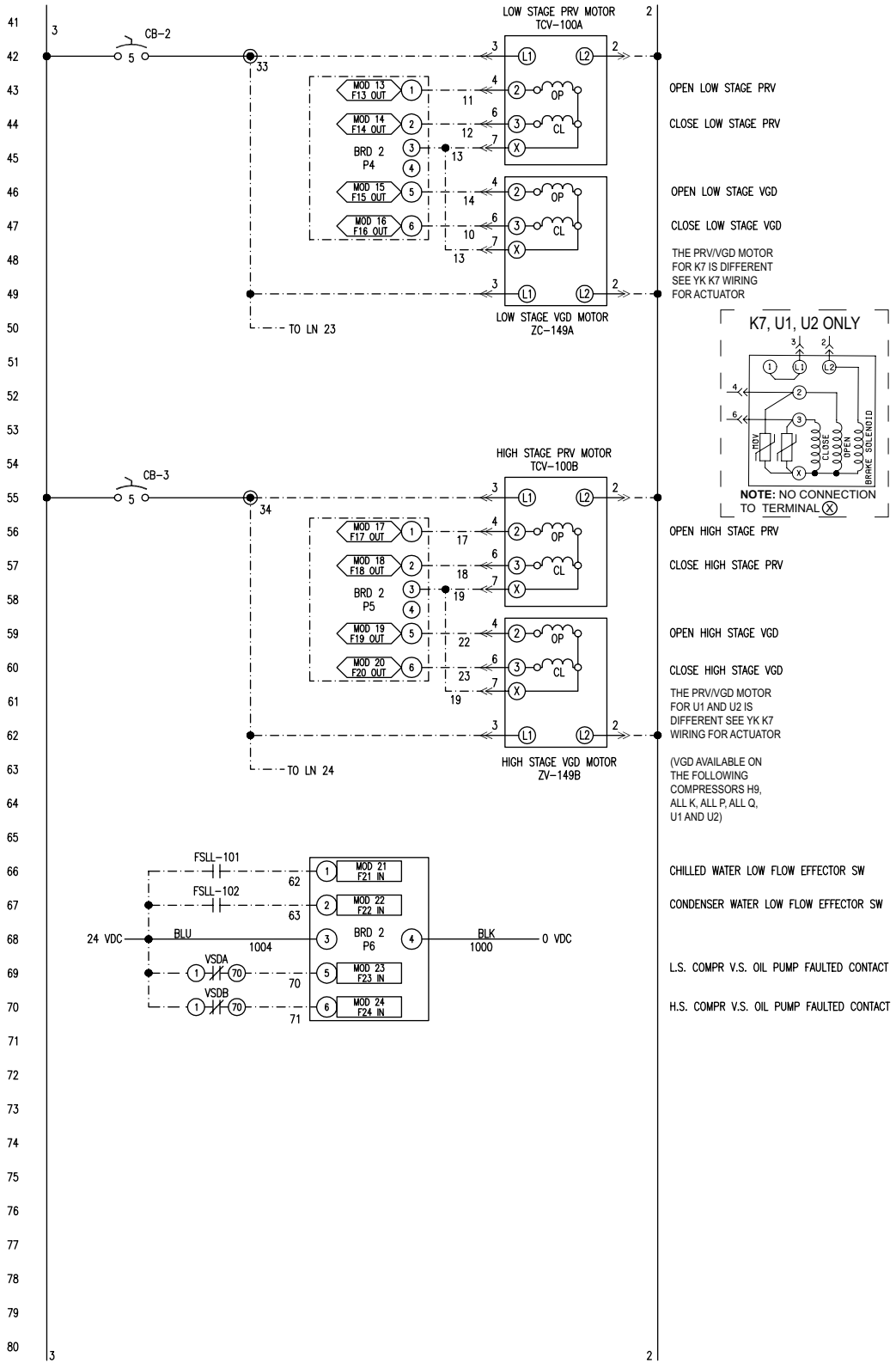

FIGURE 8 - DIGITAL BOARD 2 FOR REMOTE STARTER (CONT'D)

ANALOG BOARD 2 FOR REMOTE STARTER

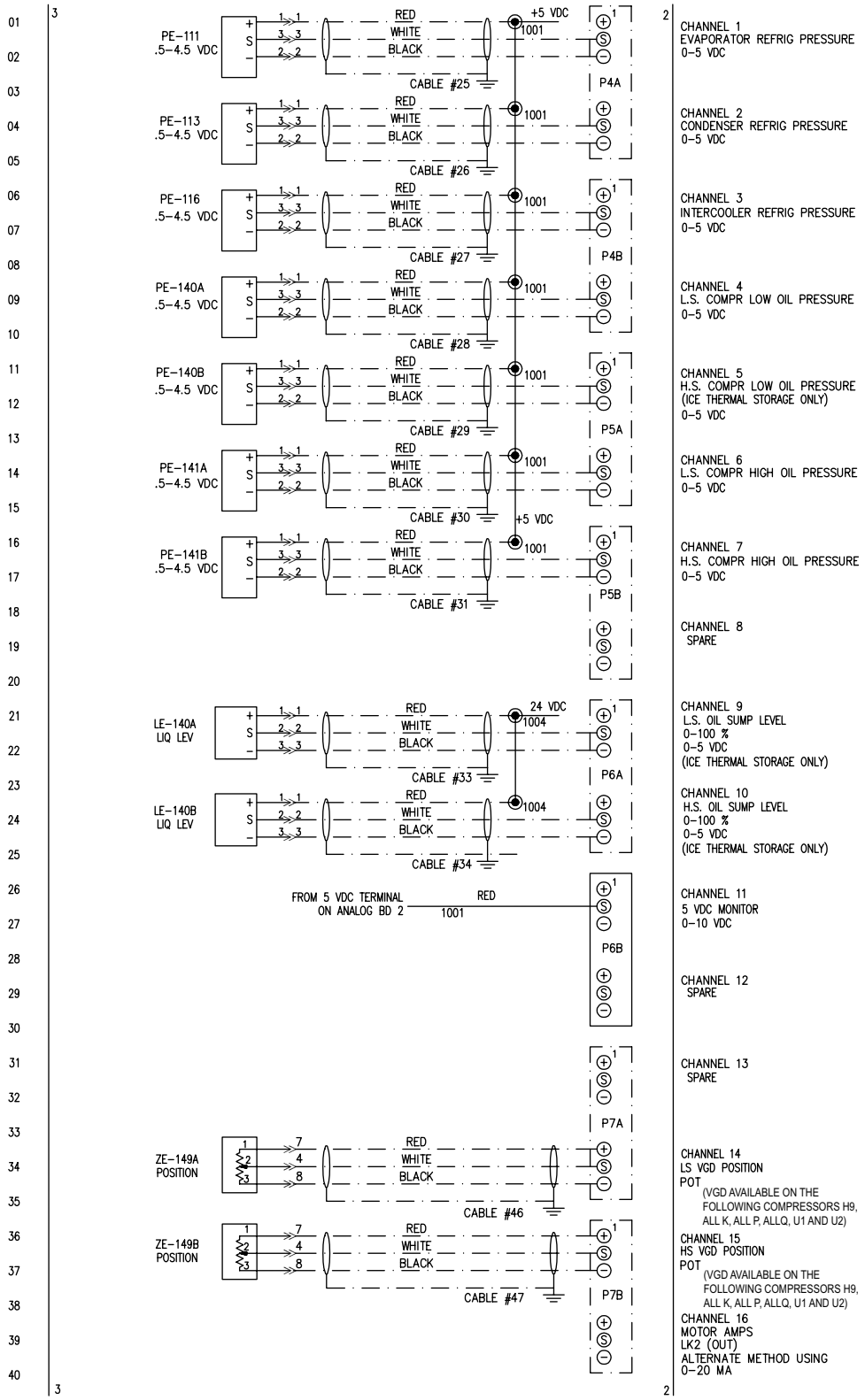

FIGURE 9 - ANALOG BOARD 2 FOR REMOTE STARTER

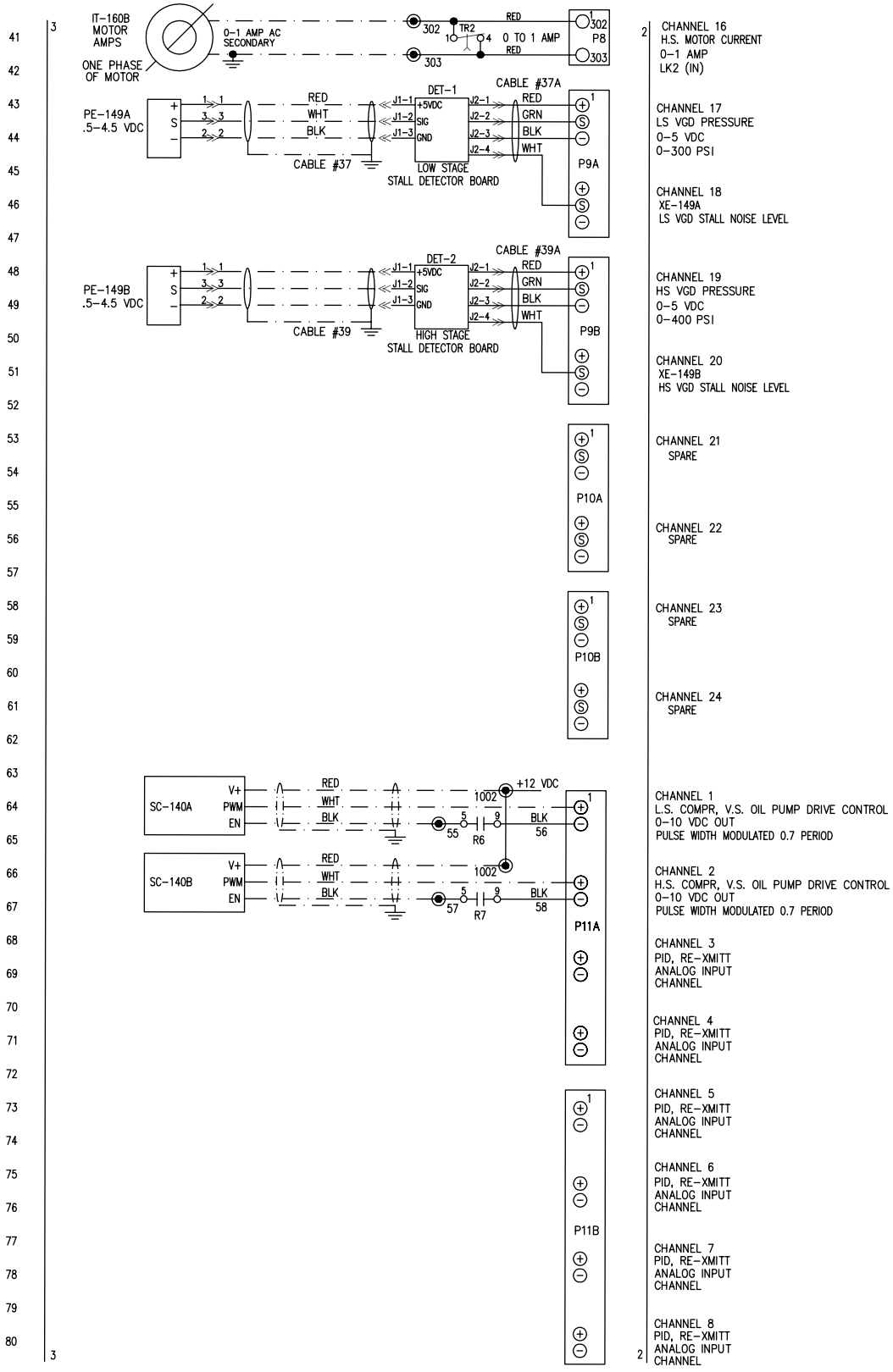

FIGURE 9 - ANALOG BOARD 2 FOR REMOTE STARTER (CONT'D)

ELEMENTARY DIAGRAM LCSSS

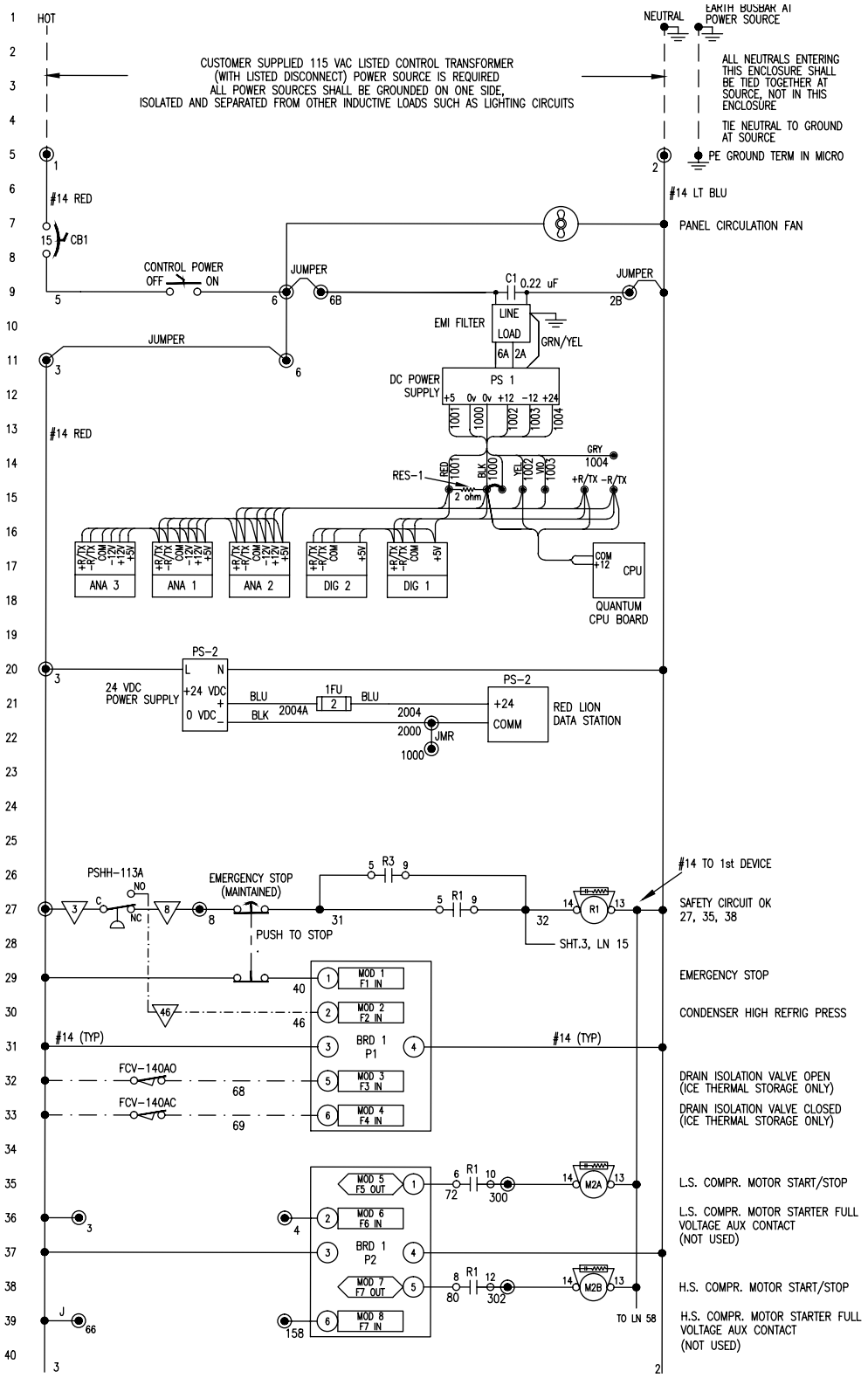

FIGURE 10 - ELEMENTARY DIAGRAM LCSSS

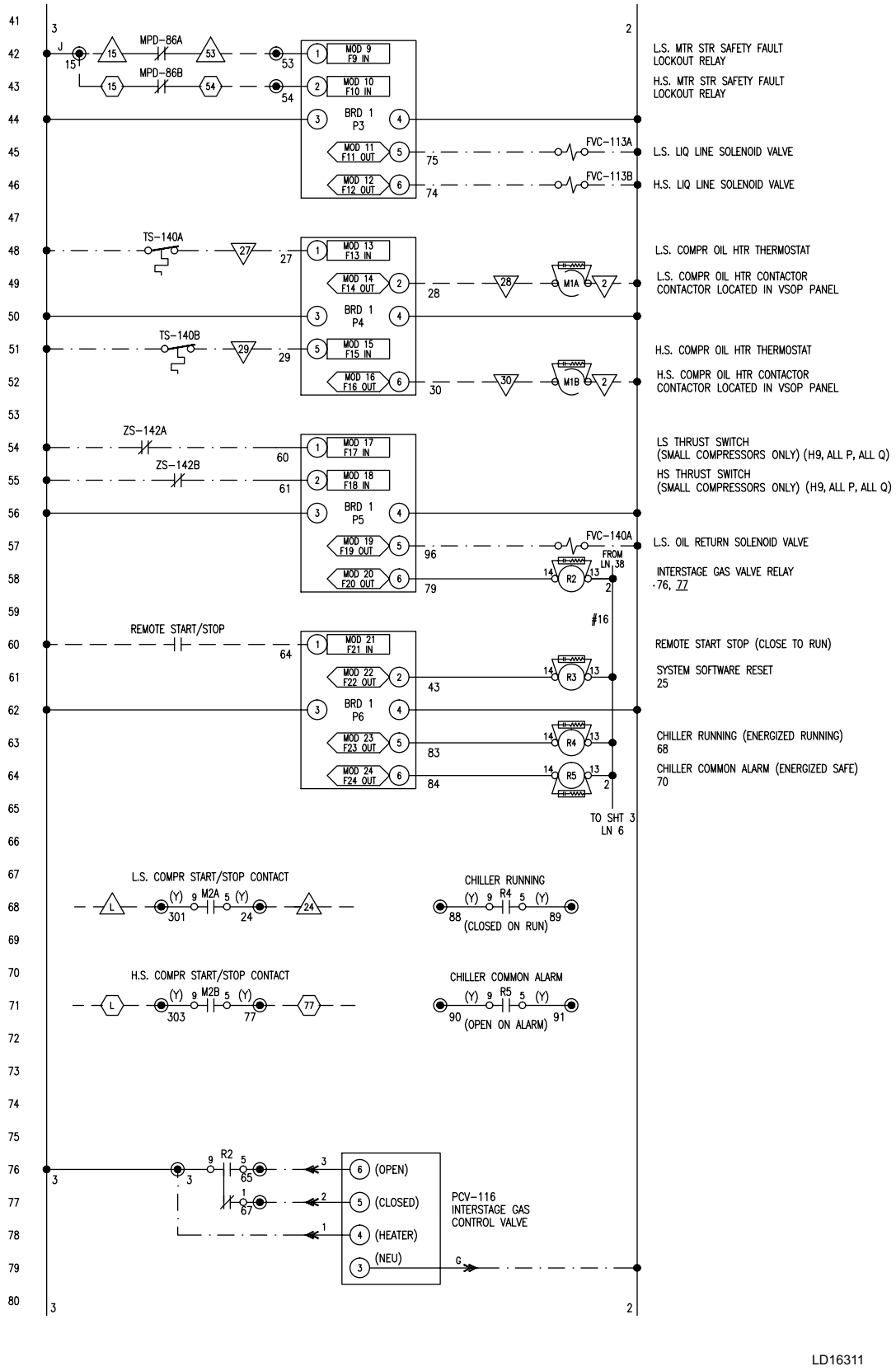

FIGURE 10 - ELEMENTARY DIAGRAM LCSSS (CONT'D)

ANALOG BOARD 1 FOR LCSSS

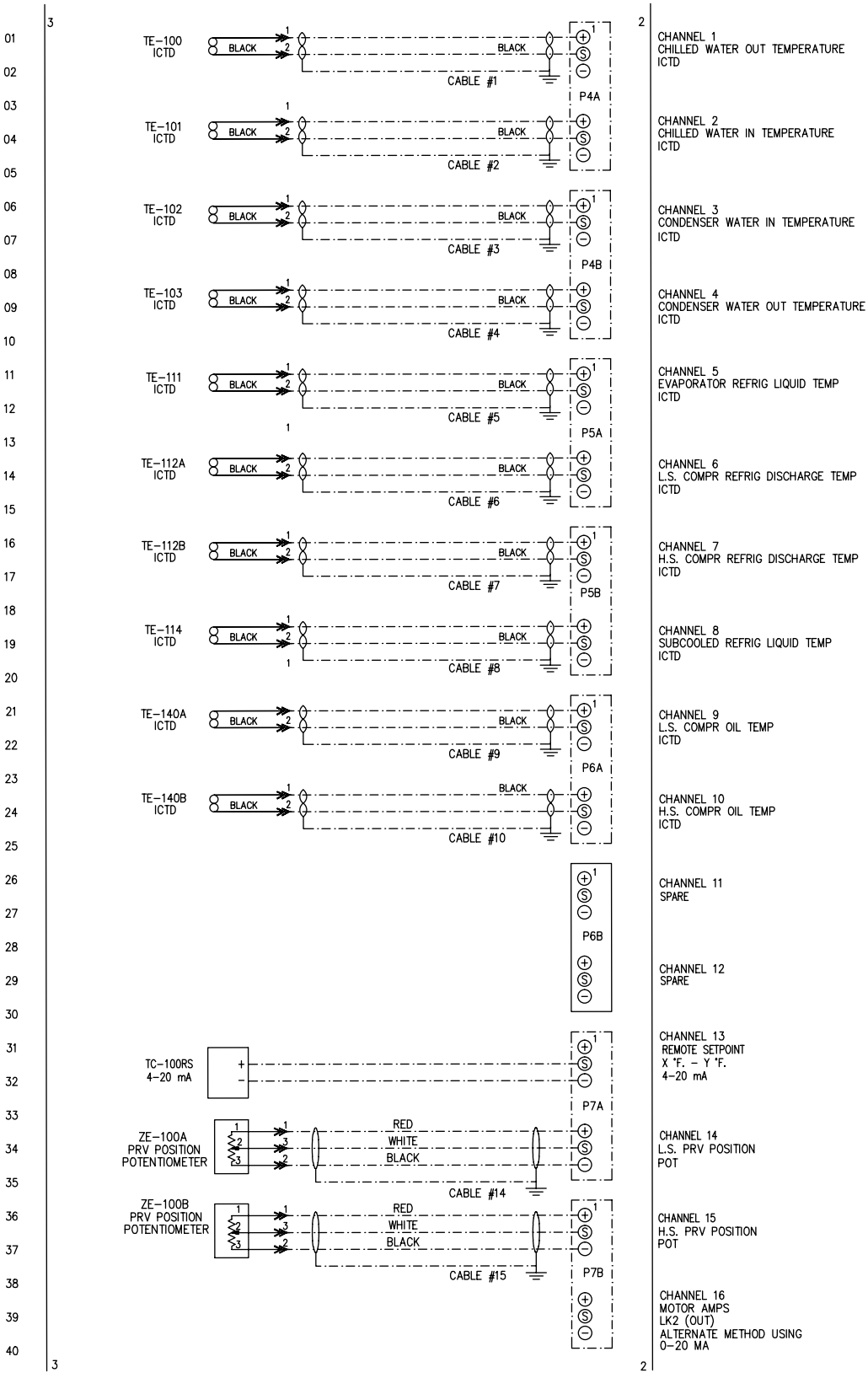

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FIGURE 11 - ANALOG BOARD 1 FOR LCSSS

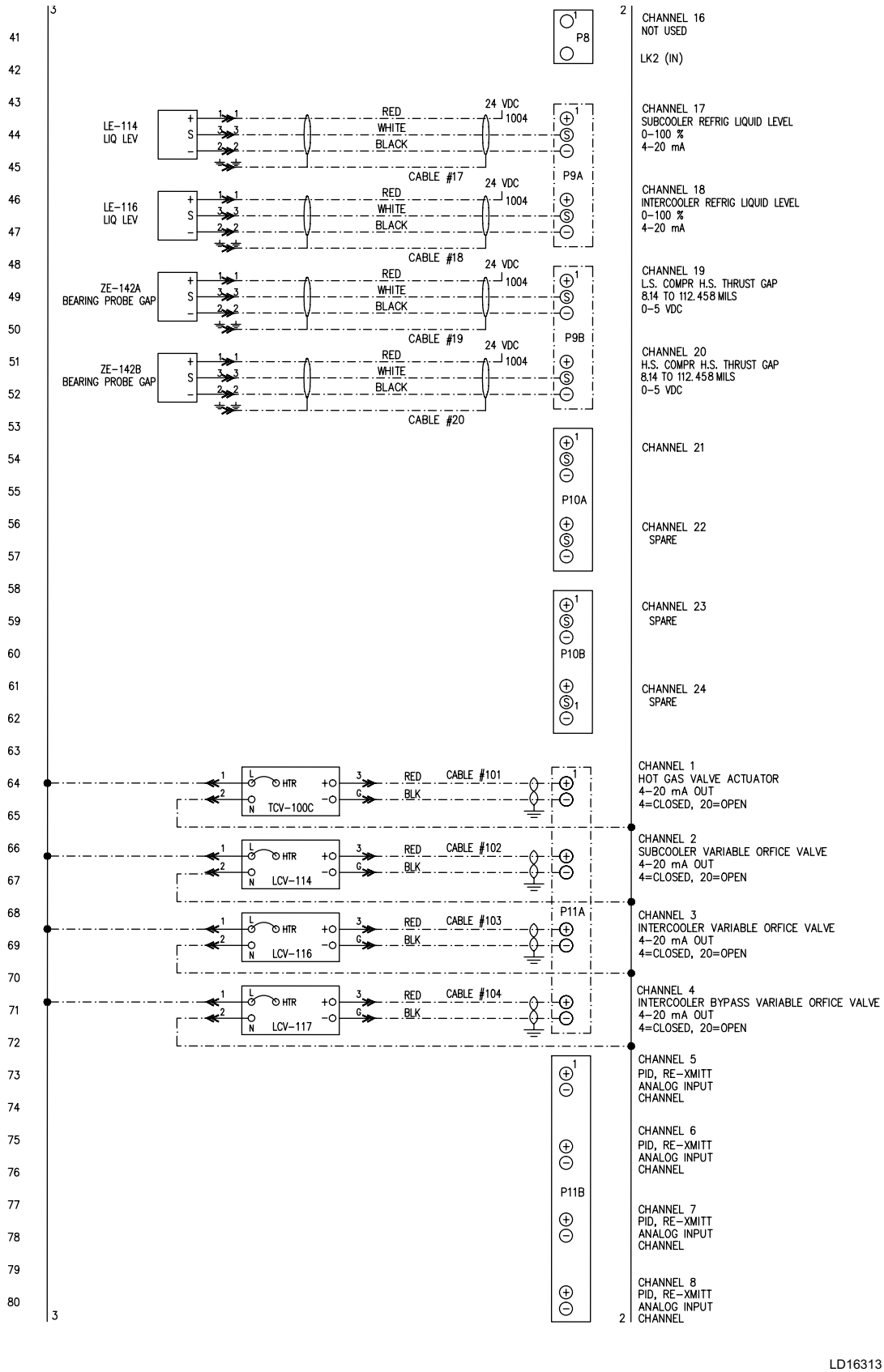

FIGURE 10 - ANALOG BOARD 1 FOR LCSSS (CONT'D)

DIGITAL BOARD 2 FOR LCSSS

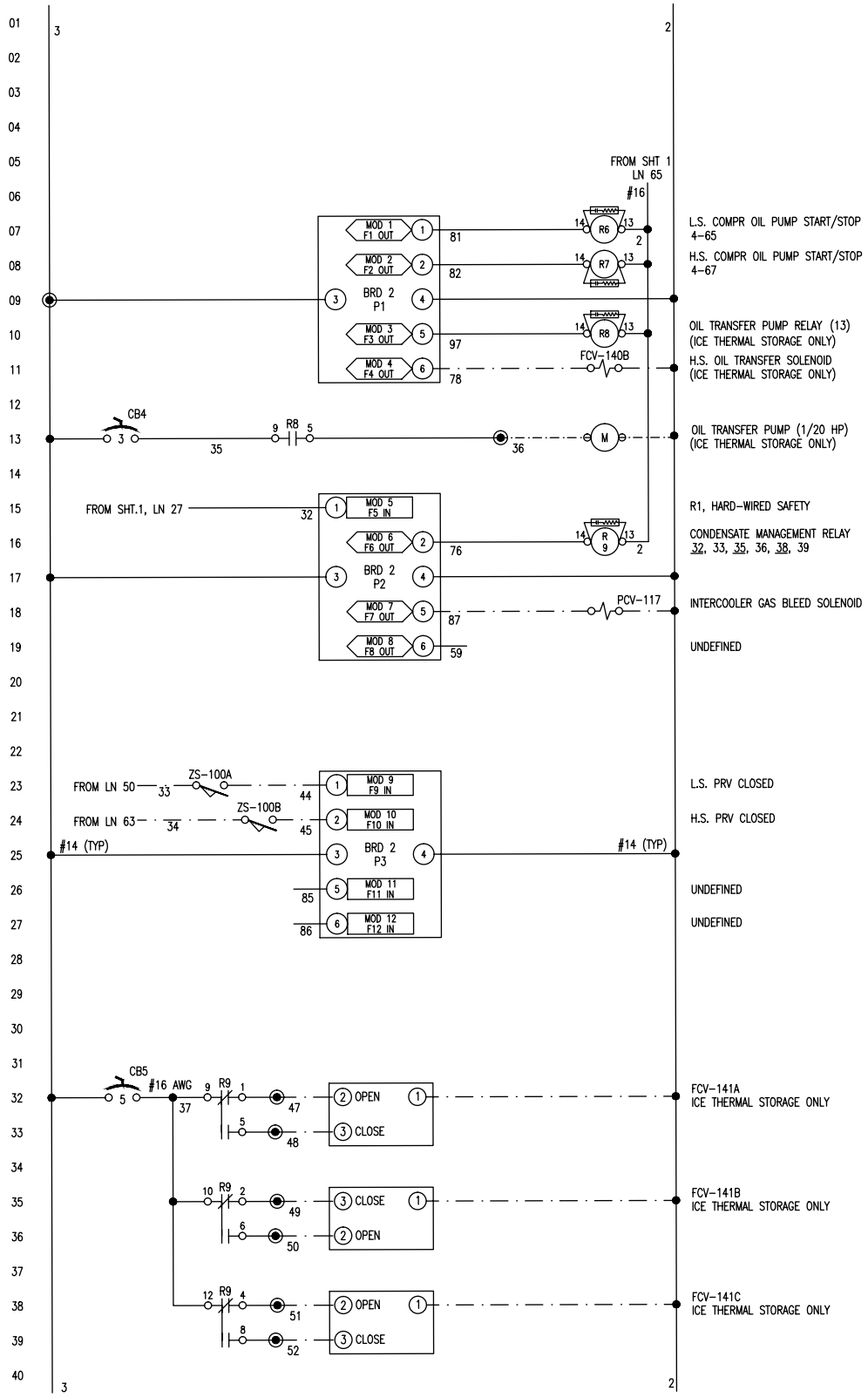

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FIGURE 12 - DIGITAL BOARD 2 FOR LCSSS

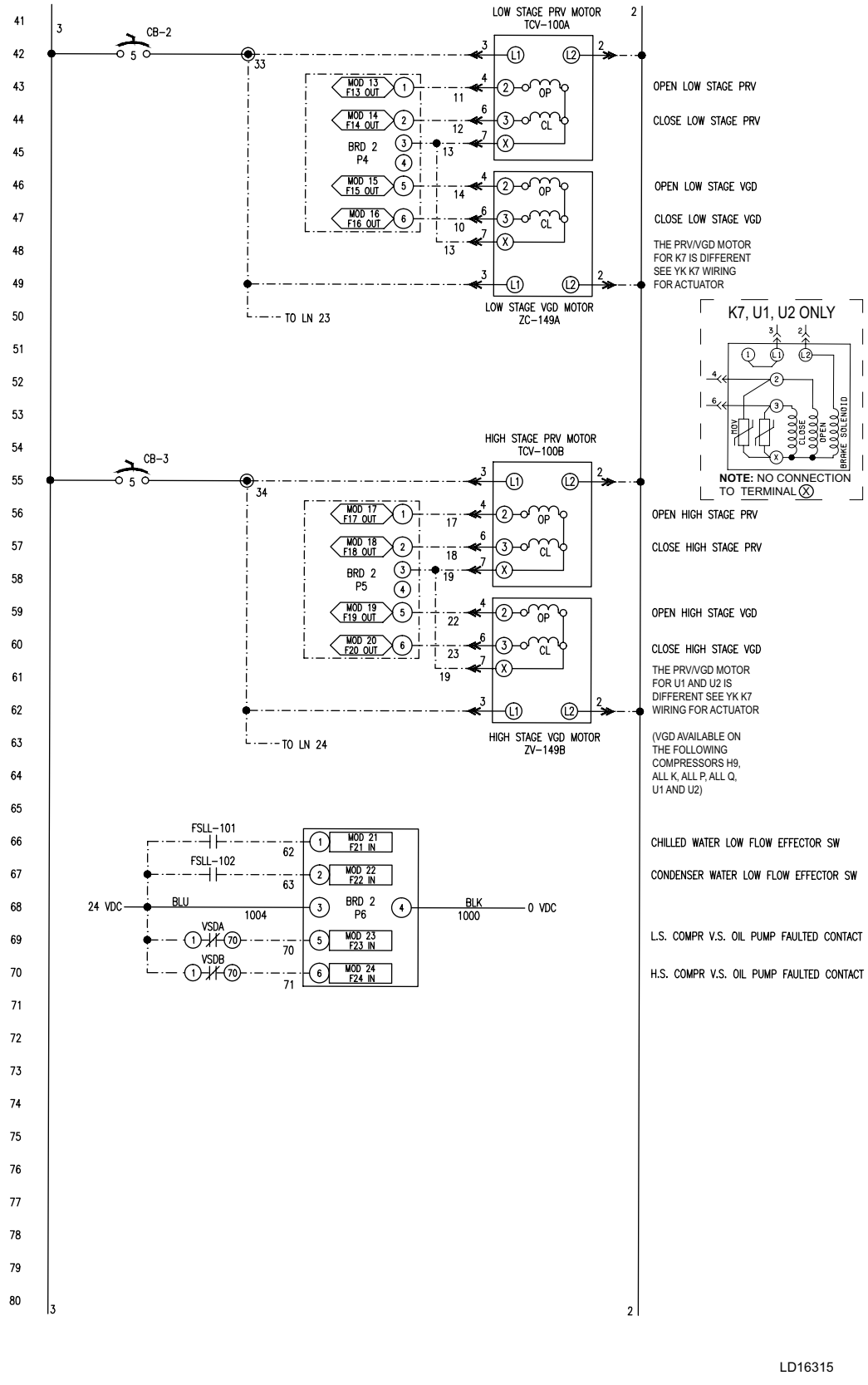
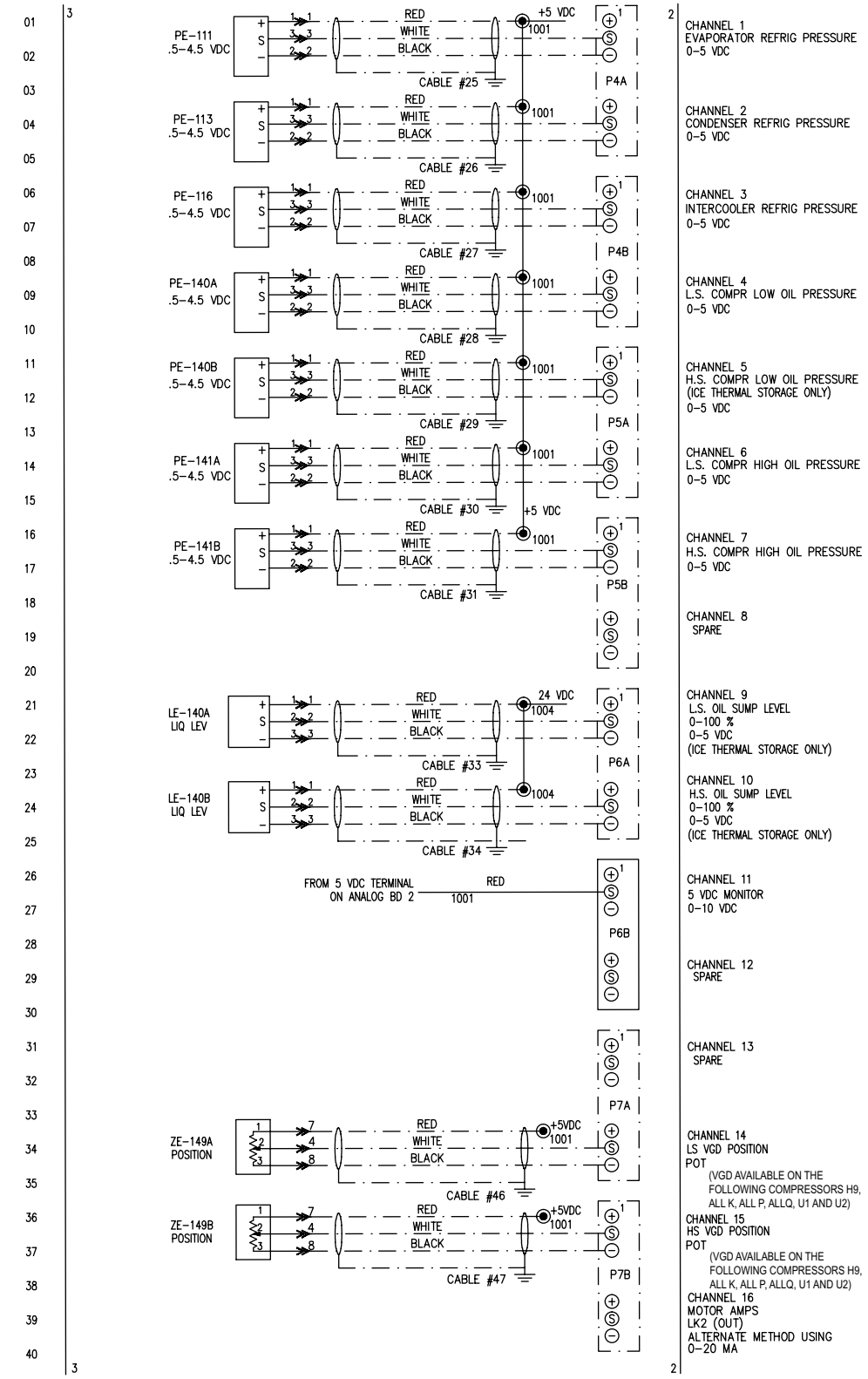


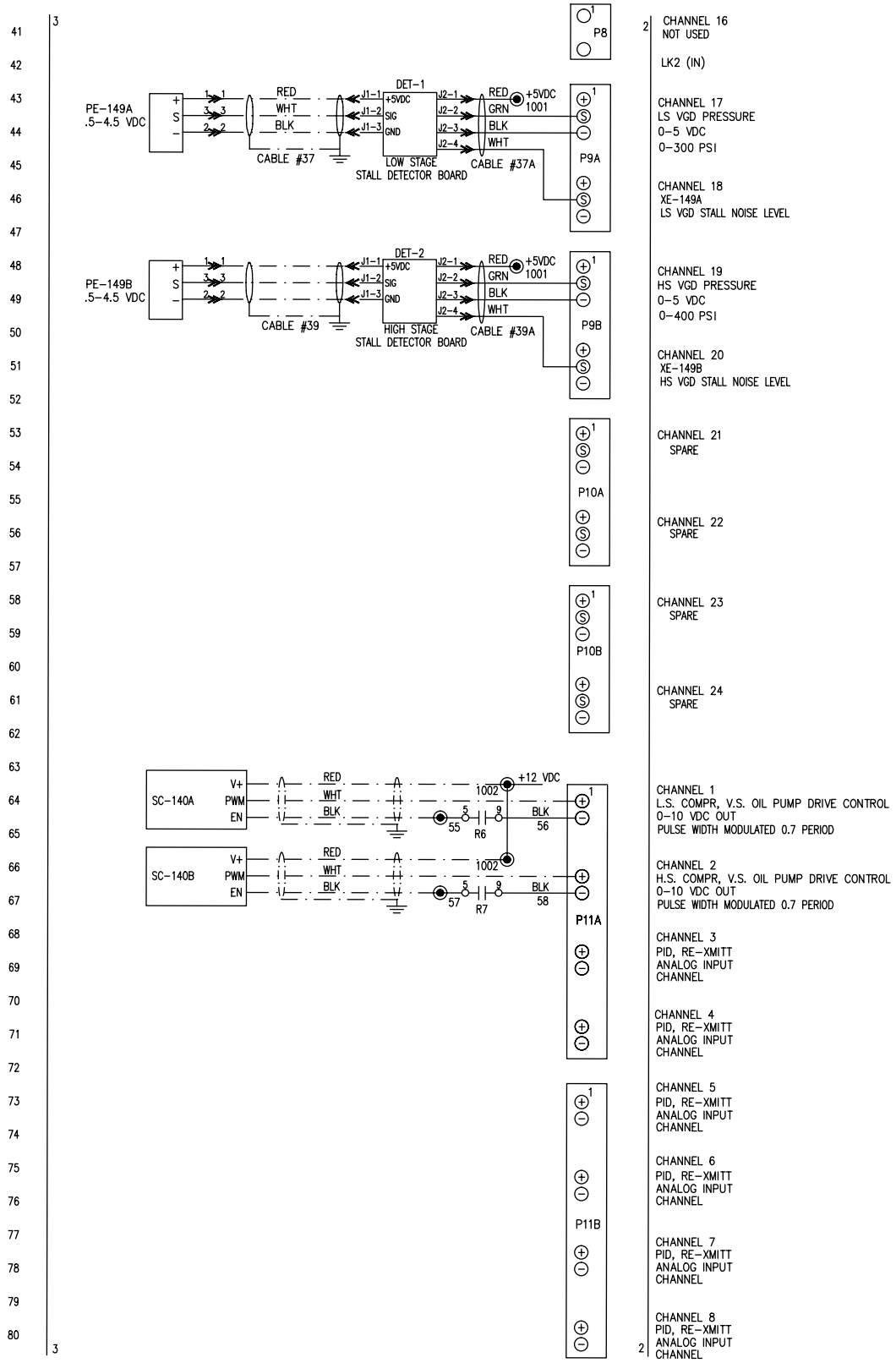
FIGURE 12 - DIGITAL BOARD 2 FOR LCSSS (CONT'D)

ANALOG BOARD 2 FOR LCSSS



LD16316

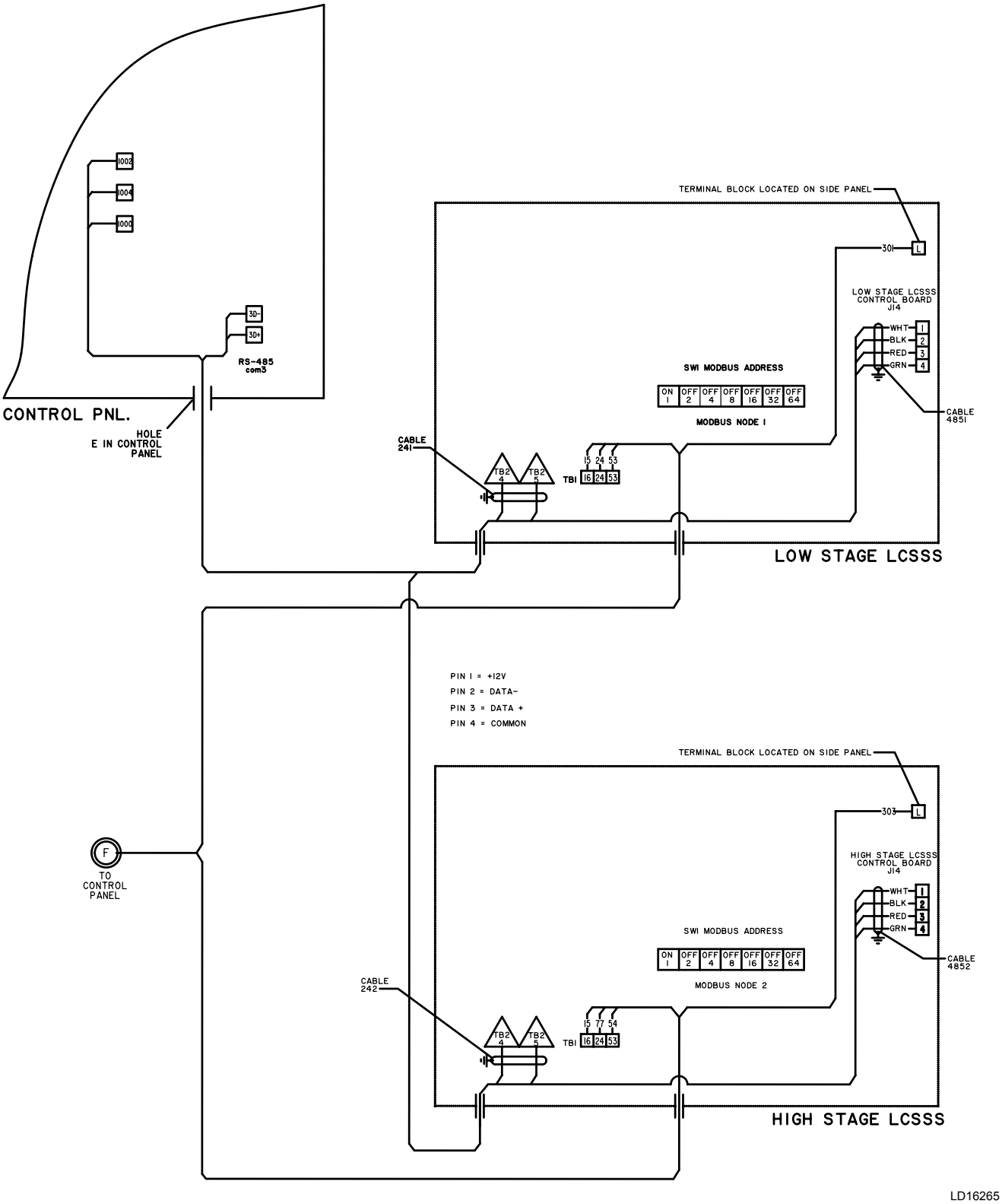
FIGURE 13 - ANALOG BOARD 2 FOR LCSSS



LD16317

FIGURE 13 - ANALOG BOARD 2 FOR LCSSS (CONT'D)

COMMUNICATION WIRING TO YORK MODEL LCSSS UNIT MOUNTED STARTERS



NOTE: Only applies to CYK units with YORK Liquid Cooled Solid State Starters.

FIGURE 14 - LCSSS OPTION - COMMUNICATION WIRING TO MOUNTED STARTERS

LEGEND

CB	CIRCUIT BREAKER
FLA	FULL LOAD AMPS
FU	FUSE
HTRIA/B	3 PHASE THERMOSTATICALLY CONTROLLED 3000W OIL HEATER
M1A/B	OIL HEATER CONTACTOR
M2A/B	COMPRESSOR MOTOR STARTER
MOV	METAL OXIDE VARISTOR
OL	MOTOR STARTER OVERLOAD
PRV	PRE-ROTATION VANE MOTOR
PS	POWER SUPPLY
R	RELAY
RES	RESISTOR
SSR	SOLID STATE RELAY
SUPR	TRANSIENT SUPPRESSOR
TB	TERMINAL BASE
TS	TEMPERATURE SWITCH
VSDA/B	VARIABLE SPEED OIL PUMP DRIVE FAULT CONTACT
ZS	LIMIT SWITCH

— — —	FIELD WIRING
———	FACTORY WIRING
.....	CIRCUIT BOARD OR ENCLOSURE BOUNDARY
— - —	MECHANICAL LINKAGE
	SHIELDED CABLE
	METAL OXIDE VARISTOR
	TERMINAL CONNECTION POINT ON COMPONENT
	TERMINAL CONNECTION POINT IN MAIN CONTROL POINT
	TERMINAL CONNECTION POINT IN MAIN MOTOR STARTER
SMALL COMPR.	H9, ALL "P" COMPR., ALL "Q" COMPR.
LARGE COMPR.	H6-H3, ALL "K" COMPR., ALL "U" COMPR.
COMPR. W/VGD	H9-P8, P9, ALL "K" COMPR., ALL "U" COMPR., ALL "Q" COMPR.

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SECTION 3 - FIELD CONTROL MODIFICATIONS

1. These FIGURES show recommended field control wiring modifications (by others) to the standard Control Center Wiring Diagram.
2. If more than one of these modifications is to be utilized with a particular unit, additional consideration must be given to the application to insure proper functioning of the control system. Consult your YORK/Johnson Controls representative.
3. The additional controls and wiring for these modifications are to be furnished and installed in the field by others (see Warnings on page 2).
4. The controls specified are recommended for use, but other controls of equal specifications are acceptable.
5. All wiring shall be in accordance with the National Electrical Code, and applicable State and Local Codes.
6. Each 115VAC field connected inductive load, i.e. relay coil, motor starter coil, etc., shall have a transient suppressor wired (by others) in parallel with its coil, physically located at the coil.
7. Maximum allowable current draw between circuits 24 and 2 for field installed devices is 2 amp holding and 10 amps inrush – see Control Center Wiring Diagram in this manual.
8. The Chilled Water Flow Switch is a safety control. It must be connected to prevent operation of the chiller whenever chilled water flow is stopped. The use of the chilled water flow switch for purposes other than protection of the chiller may be accomplished in several ways. Two flow switches, a flow switch and a relay or separate contacts on the same flow switch.
9. Do not apply voltage on field wiring terminal blocks 3, 66, and 15 in YORK Control Center, as 115VAC source is fed from terminals 1 and 2.

RUN CONTACTS

When closed, these contacts signify that the unit is operating. The Control Center will display a System Run Message.

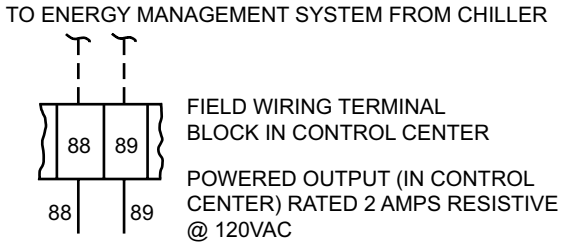


FIGURE 15 - RUN CONTACTS

ANTICIPATORY/ALARM CONTACTS

These contacts will close whenever one or more of the following WARNING conditions occurs. They will remain closed as long as the condition is in effect.

- Real time clock failure,
- Condenser or Evaporator Transducer Error*,
- Setpoint Override*,
- Condenser-High Pressure Limit,
- Evaporator-Low Pressure Limit.

On most warnings, the contacts automatically open when the condition is no longer present. On those warnings marked with an asterisk, the contacts will open only after the condition is no longer present and the ALARM RESET key is pressed in Operator (or higher) access level.

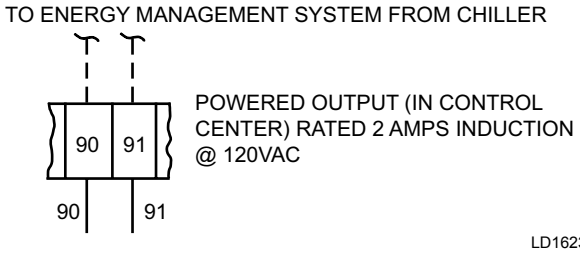
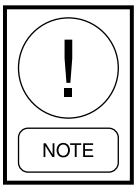


FIGURE 16 - ANTICIPATORY/ALARM CONTACTS

REMOTE START AND STOP CONTACTS FROM ENERGY MANAGEMENT SYSTEM

When the Control Center is in the remote operating mode and the compressor switch is in the "run" (l) position, with the Remote Stop Contacts open, and the Remote Mode Ready to Start Contacts closed the unit will start via a closure of the Remote Start Contacts. A subsequent opening of the Energy Management System Remote Start Contacts causes the chiller to shut down. The Control Center will display REMOTE STOP because the Energy Management System Remote Stop Contact has commanded the unit to shutdown.



Even when the chiller is applied with Remote Start-Stop (when the Control Center is in the "Remote Operating Mode"), an EMERGENCY STOP by an operator or others can STOP the compressor from the Control Center and prevent the chiller from restarting. However, the operator cannot locally start the compressor using "start" button, when the control center is in the "remote" operating mode.

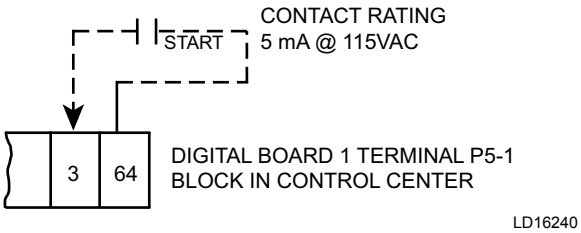


FIGURE 17 - REMOTE START AND STOP CONTACTS FROM ENERGY MANAGEMENT SYSTEM CONTACTS

CONDENSER FLOW SENSORS

When flow is sensed, the flow sensor contacts are closed. Opening of the flow sensor contacts (no flow) for 30 continuous seconds causes a cycling shutdown displaying "LOW CONDENSER WATER FLOW". The flow sensor status is bypassed for the first 30 seconds of "System Run".

Condenser Effector Type Flow Sensor

When the Effector-type Flow Switch is used, the flow switch uses the cooling effect of liquid to sense flow.

When the flow of liquid is sensed, the solid state relay output is turned on conducting current through the microboard load resistor to the +5VDC applying greater than +4VDC to the input.

When no flow of liquid is sensed, the solid state relay output is turned off, this results in less than 1VDC to the microboard input and the Control Center will display the following message: LOW CONDENSER WATER FLOW.

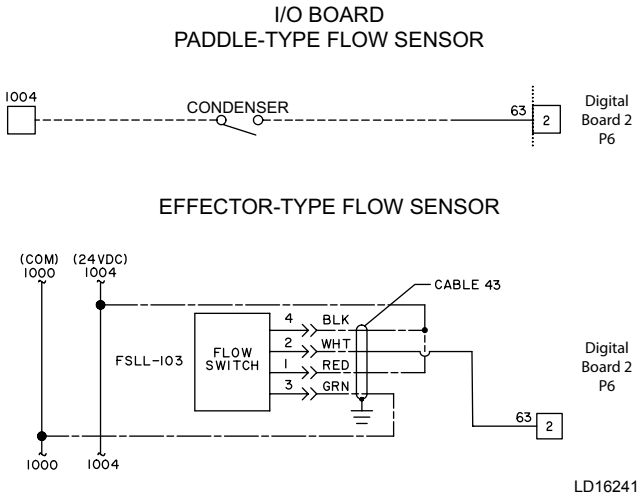


FIGURE 18 - CONDENSER FLOW SWITCHES

Condenser Paddle Type Flow Sensor

When condenser water is flowing, the flow switch contact will close. Opening of the Condenser Water Flow Switch Contacts for 2 continuous seconds will cause unit shutdown. The flow switch status is checked 30 seconds into "System Run" and continuously thereafter. The Control Center will display the following message: LOW CONDENSER WATER FLOW.

EVAPORATOR FLOW SENSORS

When flow is sensed, the flow sensor contacts are closed. Opening of the flow sensor contacts (no flow) for 2 continuous seconds causes a shutdown displaying "LOW CHILLED WATER FLOW". The flow sensor status is bypassed for the first 25 seconds of "System Prelube".

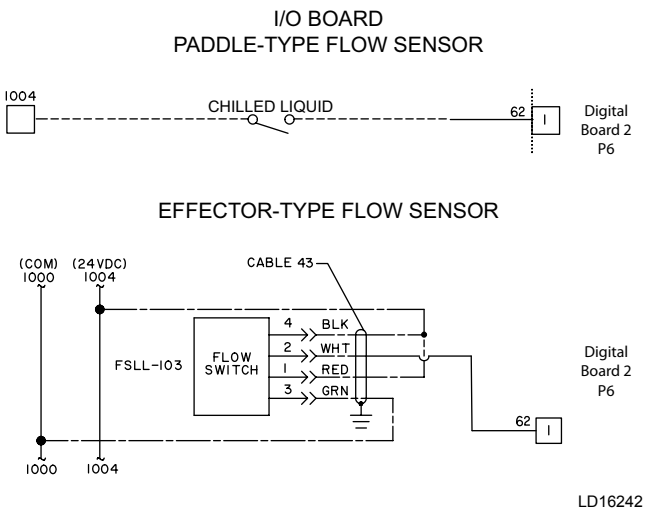


FIGURE 19 - EVAPORATOR FLOW SENSORS

Evaporator Effector Type Flow Sensor

When the Effector-type Flow Switch is used, the flow switch uses the cooling effect of liquid to sense flow.

When the flow of liquid is sensed, the relay output is turned on conducting current through the microboard's digital input.

When no flow of liquid is sensed, the relay output is turned off, this results in a no flow signal to the digital inputs.

Evaporator Paddle Type Flow Sensor

When Evaporator Water is flowing, the flow switch contact will close. If the flow switch opens for 2 seconds, the unit shuts down.

TWO UNIT SEQUENCE CONTROL

Provides that cycling thermostat RWT will automatically cycle either #1 or #2 unit. Timer 3TR is an additional feature which prevents simultaneous starting of lead and lag unit following a power failure and eliminates nuisance starting of lag unit due to periodic fluctuations in temperature. For two unit sequence control kit, order YORK Accessory Kit No. 466-61597T for controls as specified with NEMA 1 enclosure.

RWT has 20°F to 80°F range with adjustable differential of 3-1/2 to 14°F; 6 ft. of capillary with 3/8" x 5" bulb and 1/2" NPT brass well (maximum liquid DWP 300 psig). The thermostat is drawn to indicate its operation closes on rise. A 1/2" pipe coupling in the return chilled water line from the building must be furnished (by others) for RWT control well.

MULTIPLE UNITS (TWO) – SERIES OPERATION

The supply chilled water temperature to the building is normally determined by the "Chilled Liquid Temp." setpoint for Unit #2. When lead selector position of sequence control kit (Refer to *Figure 20 on Page 42*) is Unit #1, the supply chilled water temperature to the building will be the temperature control setpoint on Unit #1 Control Center. If lower temperature is desired, reprogram the "Chilled Liquid Temp." setpoint for Unit #1.

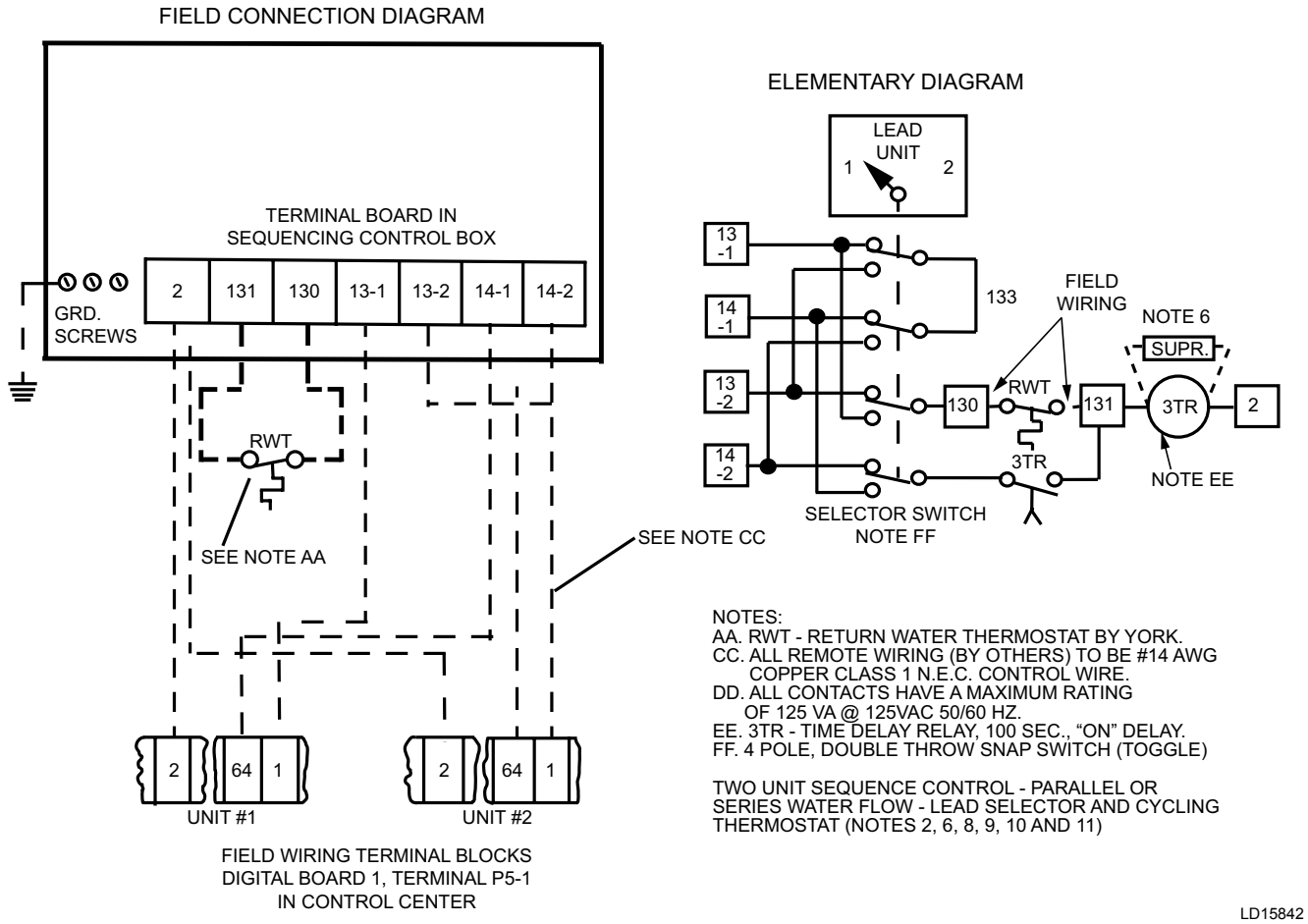


FIGURE 20 - TWO UNIT SEQUENCE CONTROL

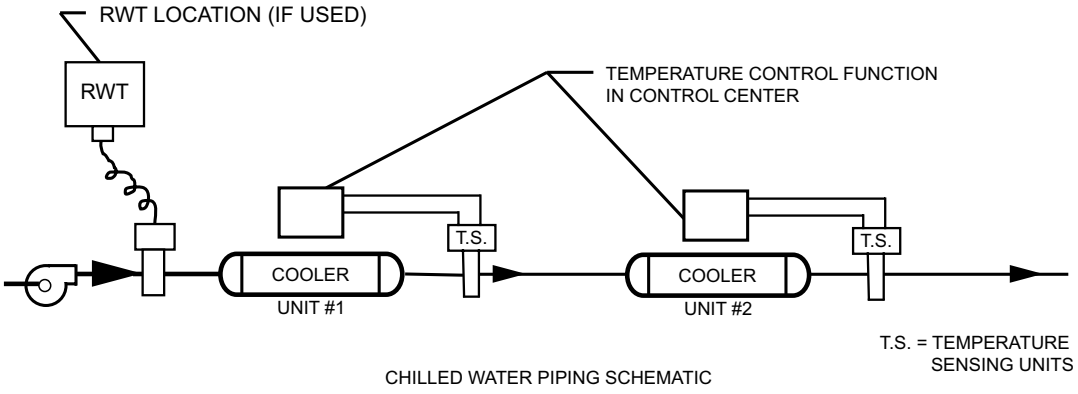
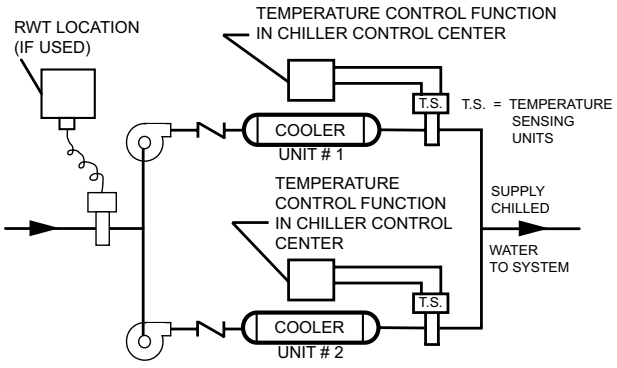


FIGURE 21 - MULTIPLE UNITS (TWO) - SERIES OPERATION

MULTIPLE UNITS (TWO) – PARALLEL OPERATION – INDIVIDUAL UNIT PUMPS

This piping arrangement must take into account that the chilled water pumps associated with each evaporator are cycled ON and OFF with the unit. This results in reduced chilled water flow rates whenever a single unit can handle the cooling load. Because no chilled water flows through the inoperative unit, the mixed water temperature peculiar to using a single pump is avoided. When one unit is cut-out by the sequence control (refer to *Figure 20 on Page 42*) the temperature of the supply chilled water does not change.



CHILLED WATER PIPING SCHEMATIC

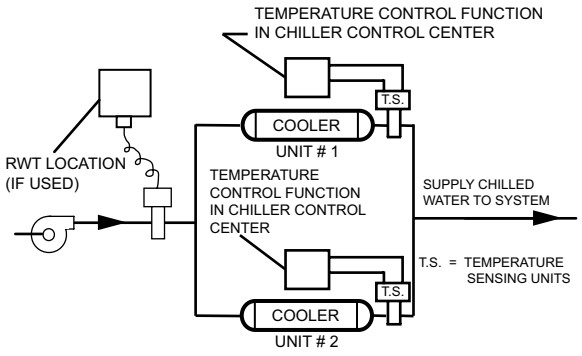
MULTIPLE UNITS - PARALLEL OPERATION:
IN THIS ARRANGEMENTS, THE INDIVIDUAL CHILLED WATER PUMP IS STOPPED WHEN THE ONE UNIT IS SHUT DOWN AT APPROXIMATELY 40% SYSTEM LOAD. LEAVING CHILLED WATER TEMPERATURE IS CONSTANT (± 1/2°F) AT ALL LOADS. (NOTES 8 and 11)

LD16245

FIGURE 22 - MULTIPLE UNITS (TWO) PARALLEL OPERATION - INDIVIDUAL UNIT PUMPS

MULTIPLE UNITS (TWO) – PARALLEL OPERATION – SINGLE CHILLED WATER PUMP

For this piping arrangement, each chiller's water sensor is located in its own leaving water nozzle. This produces a constant "mixed" chilled water temperature when both units are operating. When either unit is cycled off by the sequence control (*see Figure 20 on Page 42*), mixed chilled water temperature will rise as a result of uncooled return water flowing through the inoperative unit. For individual unit chilled water pump piping, refer to *Figure 23 on Page 43*.



CHILLED WATER PIPING SCHEMATIC

MULTIPLE UNITS - PARALLEL OPERATION:
IN THIS ARRANGEMENTS, WHEN ONE UNIT IS SHUT DOWN AT APPROXIMATELY 40% LOAD, THE CHILLED WATER TEMPERATURE SUPPLY TO THE SYSTEM RISES TO THE MIXED TEMPERATURE OF THE CHILLED WATER LEAVING BOTH UNITS, FOR ALL LOADS DOWN TO MINIMUM CAPACITY. LEAVING CHILLED WATER TEMPERATURE IS CONSTANT (± 1/2°F) AS LONG AS BOTH UNITS ARE IN OPERATION. (NOTES 8 and 11)

LD16246

FIGURE 23 - MULTIPLE UNITS (TWO) PARALLEL OPERATION - SINGLE CHILLED WATER PUMP

REMOTE LEAVING CHILLED LIQUID SETPOINT

Remote Leaving Chilled Liquid Temperature Setpoint Reset can be accomplished by supplying (by others) 4-20mA or Control Center. The **Leaving Chilled Liquid Temperature Setpoint** is programmable over the range of 38°F to 70°F (water applications), 10°F to 70°F (brine applications). The setpoint can be remotely changed over the range of the locally programmed **Remote Reset Temperature Range** setpoint.

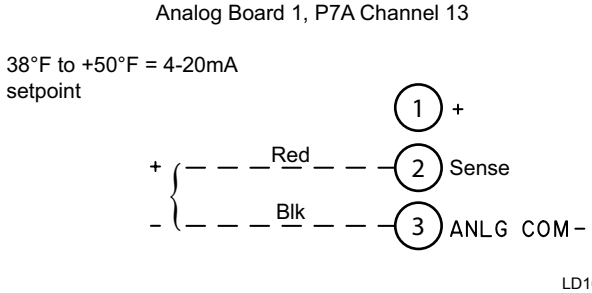


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FIGURE 24 - REMOTE HARDWIRED ANALOG TEMPERATURE SETPOINT

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SECTION 4 - ENERGY MANAGEMENT SYSTEMS

The CYK chiller design allows for ease of interfacing with Energy Management Systems (EMS). The Control Center includes unit status contacts, provisions for remote control inputs and provisions for remote setpoint reset of leaving chilled liquid temperature for EMS interfacing.

Two unit status outputs are factory furnished through a field wiring terminal board in the Control Center. Each set of contacts are 170VAC power outputs, rated at 2 amperes resistive at 120VAC. Chiller status contacts are provided for unit:

- Run (System Operating) – See *Figure 15 on Page 39.*
- Anticipatory/Alarm – See *Figure 16 on Page 39.*

One input is available to the EMS, allowing for remote control of unit operation. Input device contact rating shall be 5 milliamperes at 115VAC. Field wiring terminal 64 in the Control Center permits connection for the following operation Remote Start/Stop Contacts.

Chiller cycling by the Energy Management System should be minimized. It is possible to limit the compressor motor amp draw indirectly or directly by the following methods:

1. Application of Sequence Control Kit, so only one unit is running, when a single unit can carry the cooling load.
2. Reduce the compressor-motor kW input (and thus amps), by raising the leaving chilled liquid temperature through remote temperature control setpoint in the “remote” operating mode. When remote temperature reset is accomplished by supplying a 4-20 mA signal, refer to *Figure 24 on Page 43*. Through use of the remote temperature control analog input on Analog Board 1, Channel 13, P7A connector the leaving chilled liquid temperature may be reset via a 4 to 20mA D.C. current signal.
3. Current limiting of demand during pulldown may be accomplished by using the standard PULLDOWN DEMAND LIMIT function provided in the Control Center. The “Pulldown Demand Limit” key can be programmed to limit compressor motor current from 40 to 100 percent of full load amperes, *CYK Operation and Maintenance Manual (Form 160.82-OM1).*
4. The Johnson Controls METASYS™ System may be interfaced with the chiller Control Center to provide unified chiller plant system control. The METASYS™ System directly communicates with the Control Center via the Ethernet port supporting the following protocals Modbus TCP, Ethernet /IP. All temperatures, pressures, safety alarms and cycling information known to the Control Center are then available to the METASYS™ System for integrated chiller plant control, data logging, and local and remote operator displays. The network ports also allow the Molbus RTU, Modbus ASCII, and DF1 over the serial part to start, stop, and reset the chiller’s leaving chilled water and current limit setpoints.

   BACnet MS/TP and BACnet/IP are available upon request through the Redlion DATA STATION installed in the Quantum LX control center.

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The following factors can be used to convert from English to the most common SI Metric values.

TABLE 2 - SI METRIC CONVERSION

MEASUREMENT	MULTIPLY ENGLISH UNIT	BY FACTOR	TO OBTAIN METRIC UNIT
Capacity	Tons Refrigerant Effect (ton)	3.516	Kilowatts (kW)
Power	Horsepower	0.7457	Kilowatts (kW)
Flow Rate	Gallons / Minute (gpm)	0.0631	Liters / Second (l/s)
Length	Feet (ft)	0.3048	Meters (m)
	Inches (in)	25.4	Millimeters (mm)
Weight	Pounds (lbs)	0.4538	Kilograms (kg)
Velocity	Feet / Second (fps)	0.3048	Meters / Second (m/s)
Pressure Drop	Feet of Water (ft)	2.989	Kilopascals (kPa)
	Pounds / Square Inch (psi)	6.895	Kilopascals (kPa)

TEMPERATURE

To convert degrees Fahrenheit (°F) to degrees Celsius (°C), subtract 32° and multiply by 5/9 or 0.5556.

Example: (45.0°F - 32°) x 0.5556 = 27.2°C

To convert a temperature range (i.e., a range of 10°F) from Fahrenheit to Celsius, multiply by 5/9 or 0.5556.

Example: 10.0°F range x 0.5556 = 5.6 °C range

P.O. Box 1592, York, Pennsylvania USA 17405-1592

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