# MARYLAND STADIUM AUTHORITY PROJECT:

## M&T BANK STADIUM (RAVENS)

## Automatic Temperature Controls ASBUILT

OWNER: MARYLAND STADIUM AUTHORITY

GENERAL CONTRACTOR: PEPCO ENERGY SERVICES

ATC & EMS CONTRACTOR: ENGINEERED SERVICES, INC.

DATE: November 22, 2010

Index




ESI engineered services inc

45150 Business Court
Suite 100
Sterling, Virginia 20166

Tel. (703) 471–6310
Fax (703) 471–3919

## WIRING/SCHEMATIC SYMBOLS

- FR — RELAY – RELAY COIL
- N.O. CONTACTS
- N.C. CONTACTS
- 120 VAC / 24 VAC — TRANSFORMER
- THERMOSTAT, MAKE ON FALL IN TEMP.
- THERMOSTAT/HUMIDISTAT/ MAKE ON RISE IN TEMP./HUMIDITY
- FREEZESTAT, T'STAT, BREAK ON FALL IN TEMP.
- FIRESTAT, T'STAT, BREAK ON RISE IN TEMP.
- N.C. HIGH PRESSURE SWITCH
- N.O. HIGH PRESSURE SWITCH
- N.C. LOW PRESSURE SWITCH
- N.O. LOW PRESSURE SWITCH
- SWITCH – SWITCH
- FLOW SWITCH
- FLOAT SWITCH, BREAK ON RISE
- FLOAT SWITCH, BREAK ON FALL
- FUSE
- SOLENOID
- GROUND
- RESISTOR
- THERMAL SWITCH
- PILOT LIGHT / STROBE
- HORN / BELL
- INx / RET — THERMISTER OR RESISTANCE INPUT
- INx / RET — DRY CONTACTS OR PULSE INPUT
- INx / RET — SELF–POWERED 0–10VDC INPUT
- INx / RET / 24V — SEPARATELY POWERED 0–10VDC INPUT
- 24V COMMON JUMPER BAR, TERMINAL

## FLOW/DIAGRAMITC SYMBOLS

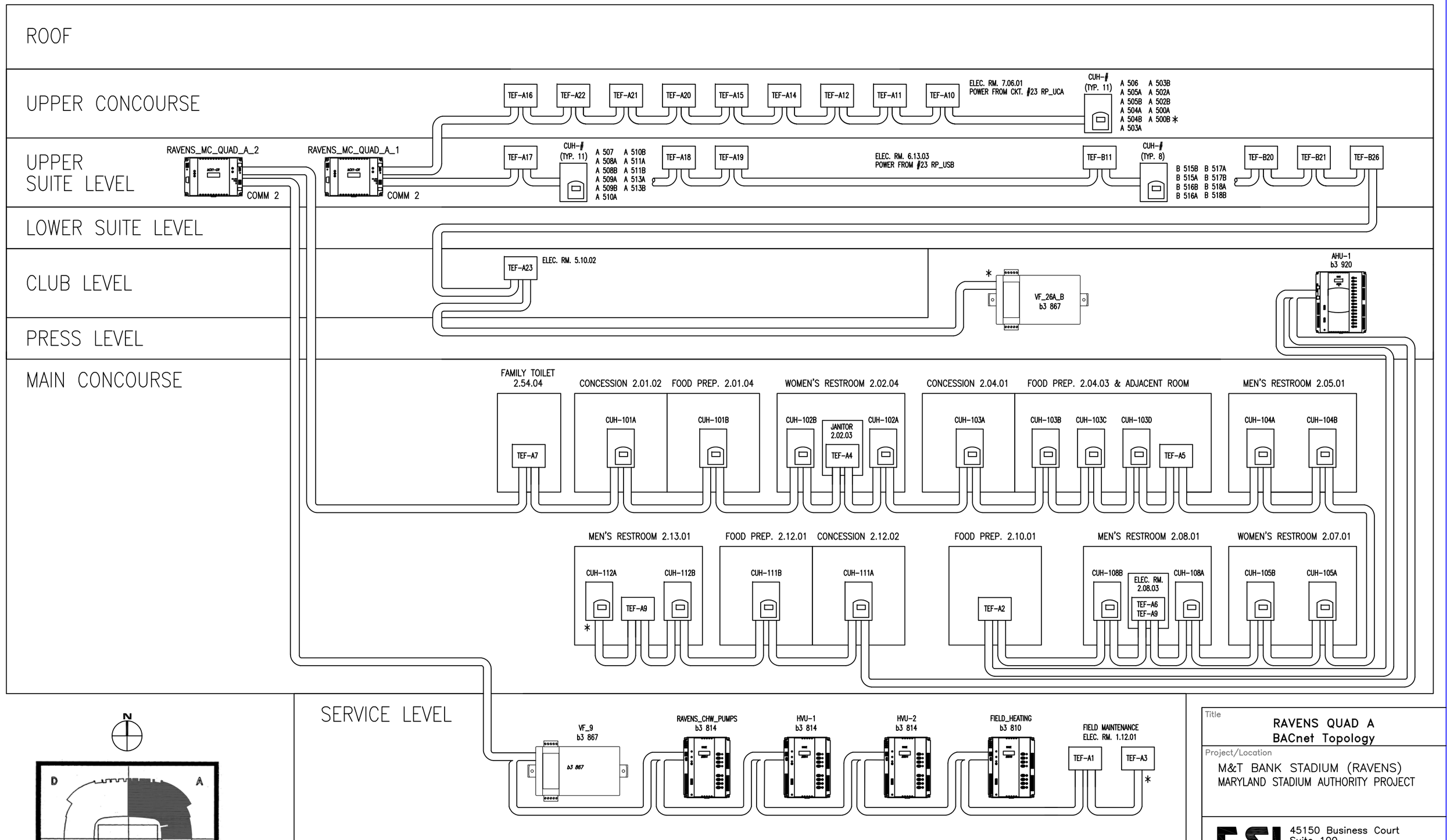
- DIGITAL CURRENT SWITCH
- ANALOG CURRENT SENSOR
- GAUGE
- WATER FLOW PADDLE SWITCH
- DUCT HUMIDITY SENSOR
- DUCT TEMP. SENSOR
- IMMERSION SENSOR
- AVERAGING SENSOR
- OUTSIDE AIR SENSOR
- FLOW METER
- ST — WALL SENSOR
- CO — WALL CO SENSOR
- STAT — THERMOSTAT
- FIRESTAT
- FREEZESTAT
- 3–WAY ELECTRIC VALVE
- 2–WAY ELECTRIC VALVE
- ELECTRIC DAMPER ACTUATOR
- N.C. CONTROL DAMPER
- N.O. CONTROL DAMPER
- SP–x — DRY MEDIA DIFFERENTIAL PRESSURE TRANSDUCER
- DP–x — WET MEDIA DIFFERENTIAL PRESSURE TRANSDUCER
- AFM — AIR FLOW MONITORING STATION
- POTENTIOMETER
- ELECTRIC HEATER

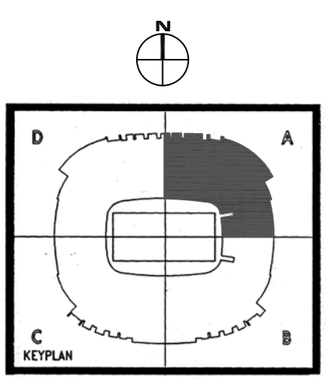
Title: **Symbols**

Project/Location:
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471–6310
Fax (703) 471–3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 1.1 Symbols |




22 AWG TWISTED SHIELDED PAIR =

NOTE:

* RAVENS_MC_QUAD_A_1: 120 OHM END-OF LINE RESISTOR AT VF_26A_B (b3 867) & AT CUH-500B (AT THERMOSTAT).
RAVENS_MC_QUAD_A_2: 120 OHM END-OF LINE RESISTOR AT TEF-A3 (BACnet RELAY) & AT CUH-112A (AT THERMOSTAT).

Title
RAVENS QUAD A
BACnet Topology

Project/Location
M&T BANK STADIUM (RAVENS)
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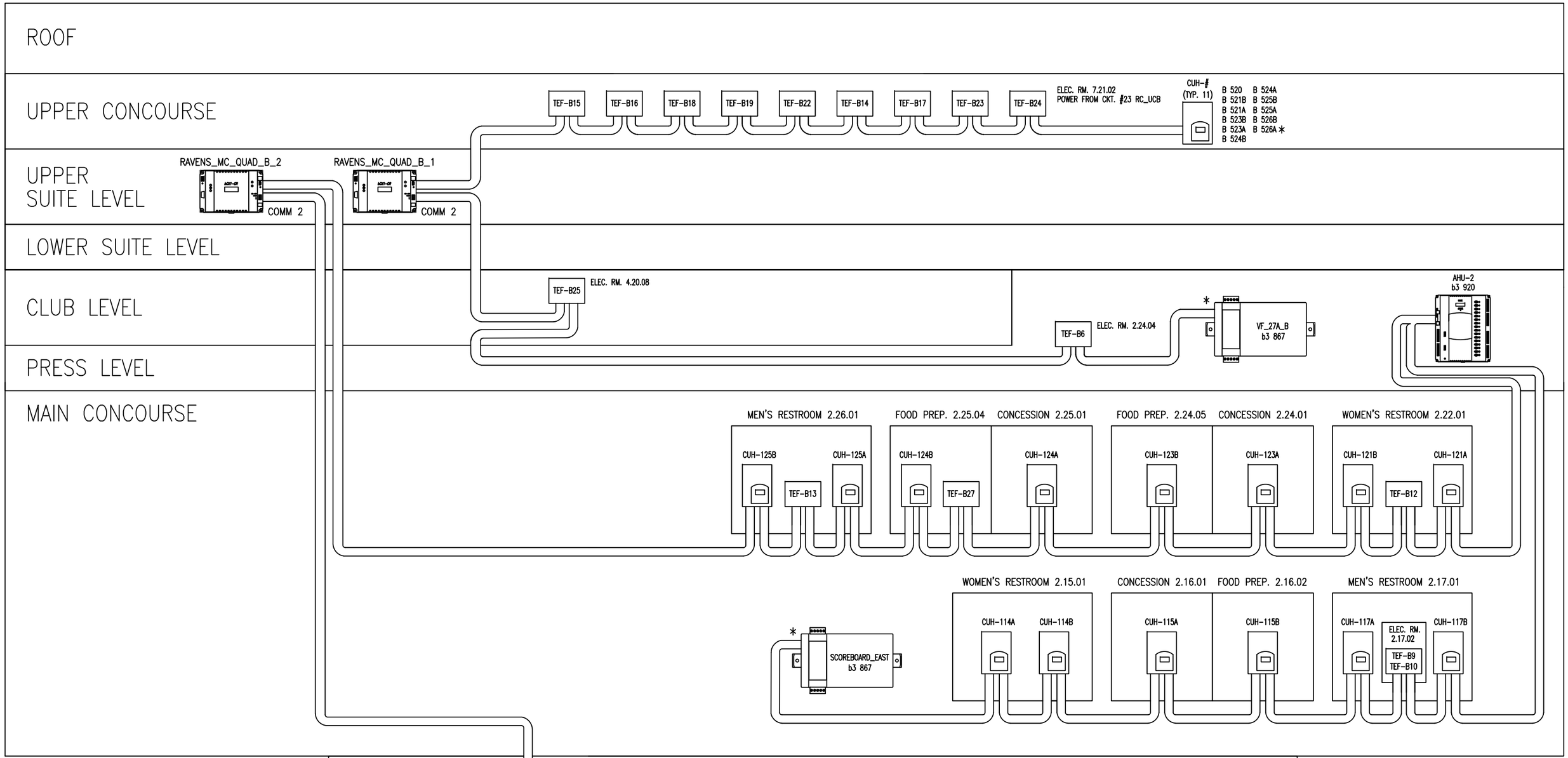
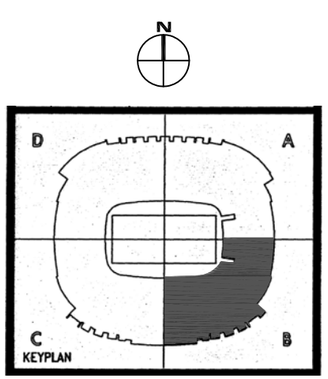
ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 2.1 RAVENS_QA_BACnet_Topology |




22 AWG TWISTED SHIELDED PAIR =

NOTE:

* RAVENS_MC_QUAD_B_1: 120 OHM END-OF LINE RESISTOR AT VF_27A_B (b3 867) & AT CUH-526A (AT THERMOSTAT).
RAVENS_MC_QUAD_B_2: 120 OHM END-OF LINE RESISTOR AT TEF-B8 (BACnet RELAY) & AT SCOREBOARD_EAST (b3 867).

Title
RAVENS QUAD B
BACnet Topology

Project/Location
M&T BANK STADIUM (RAVENS)
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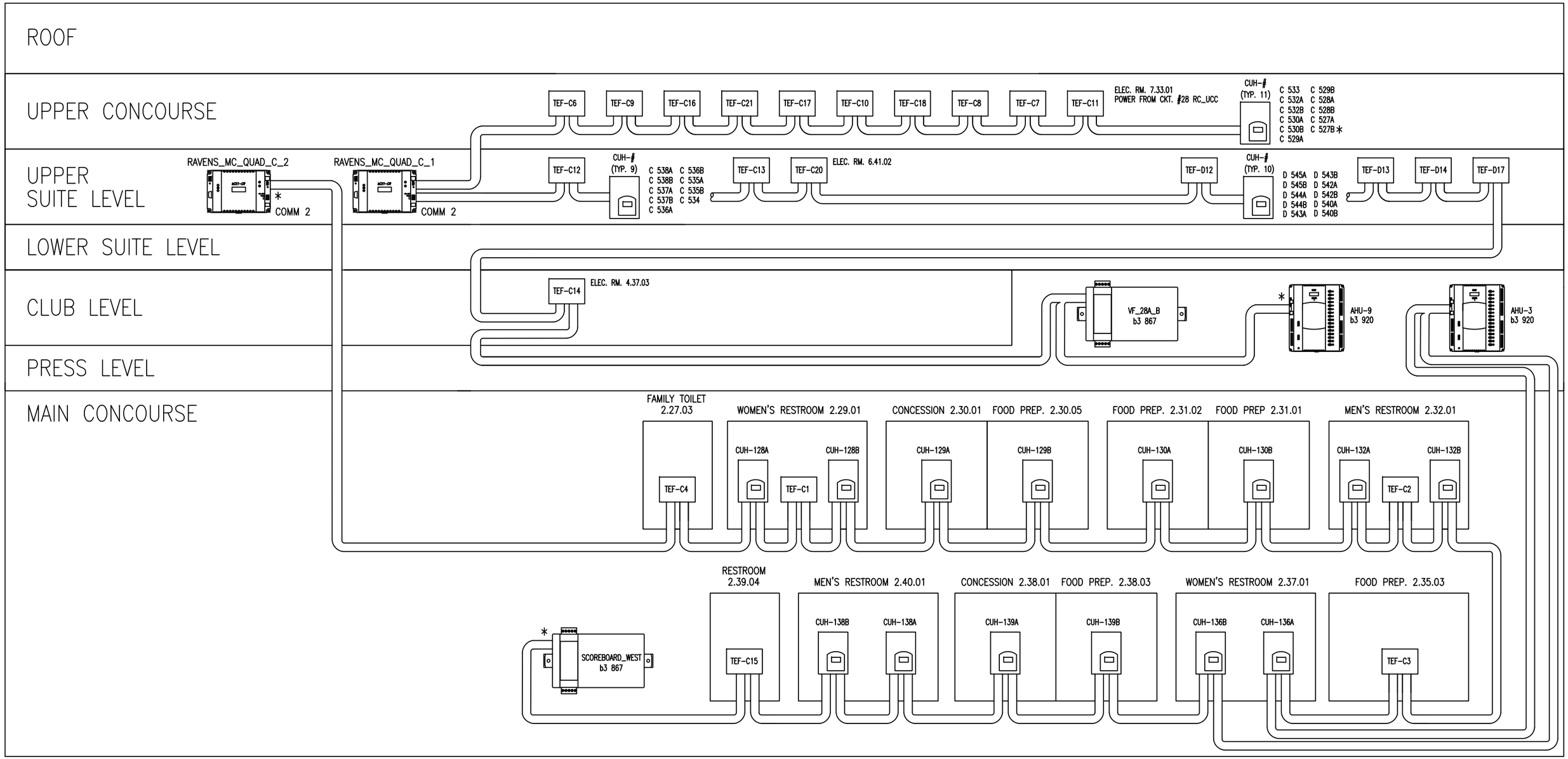
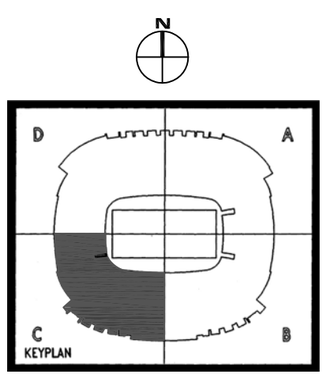
ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 2.2 RAVENS_QB_BACnet_Topology |




22 AWG TWISTED SHIELDED PAIR =

NOTE:

* RAVENS_MC_QUAD_C_1: 120 OHM END-OF LINE RESISTOR AT AHU-9 (b3 920) & AT CUH-527B (AT THERMOSTAT).
RAVENS_MC_QUAD_C_2: 120 OHM END-OF LINE RESISTOR AT RAVENS_MC_QUAD_B_2 (BCX1-CR) & AT SCOREBOARD_WEST (b3 867).

Title
RAVENS QUAD C
BACnet Topology

Project/Location
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45150 Business Court
Suite 100
Sterling, Virginia 20166
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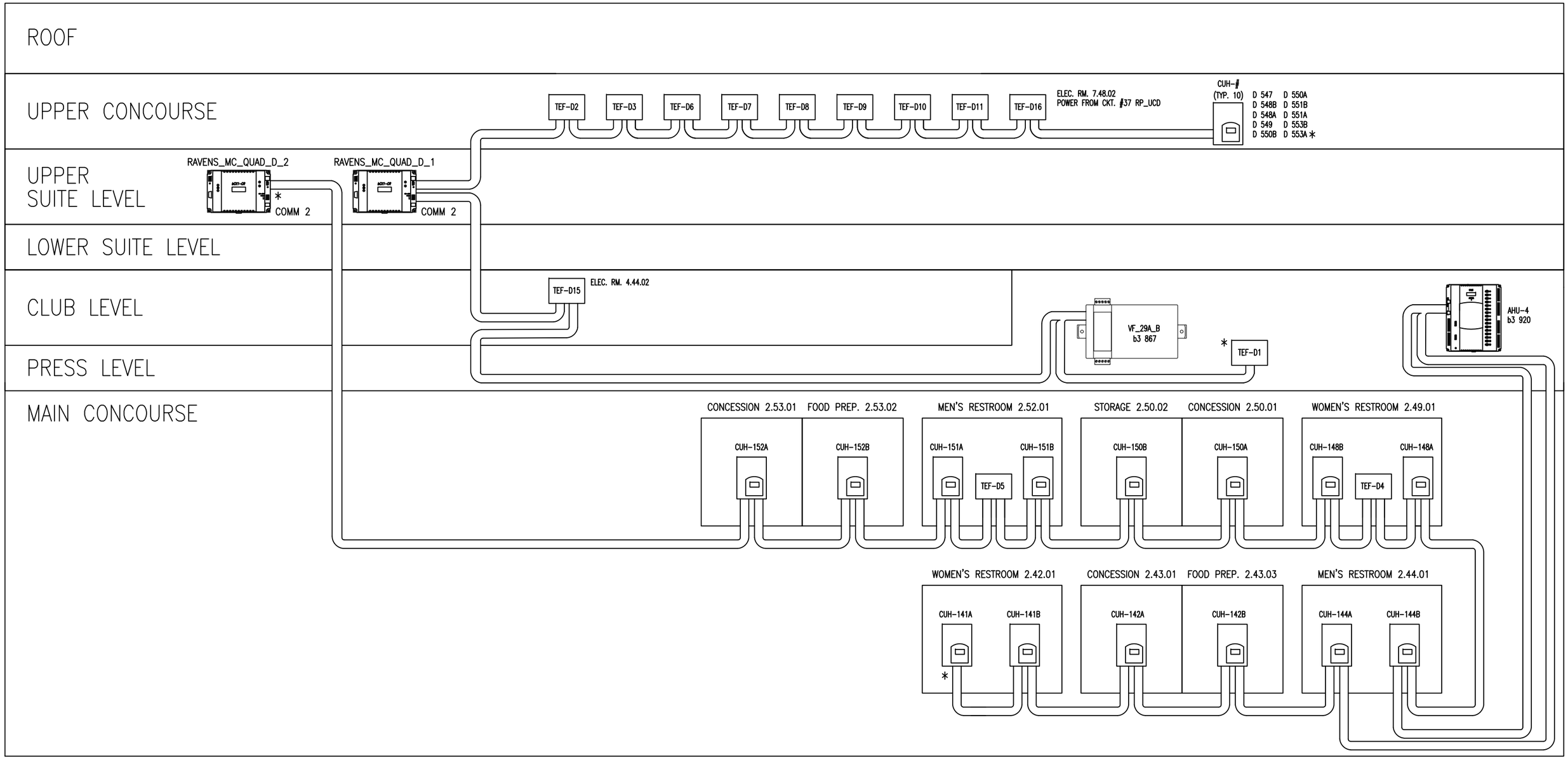
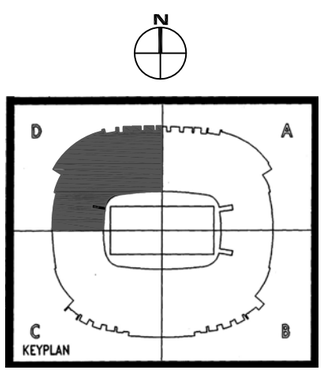
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 2.3 RAVENS_QC_AHU__Add_Bac. |




22 AWG TWISTED SHIELDED PAIR =

NOTE:

* RAVENS_MC_QUAD_D_1: 120 OHM END-OF LINE RESISTOR AT TEF-D1 (BACnet RELAY) & AT CUH-553A (AT THERMOSTAT).
RAVENS_MC_QUAD_D_2: 120 OHM END-OF LINE RESISTOR AT RAVENS_MC_QUAD_D_2 (BCX1-CR) & AT CUH-141A (AT THERMOSTAT).

Title
RAVENS QUAD D
AHU Addition to BACnet Topology

Project/Location
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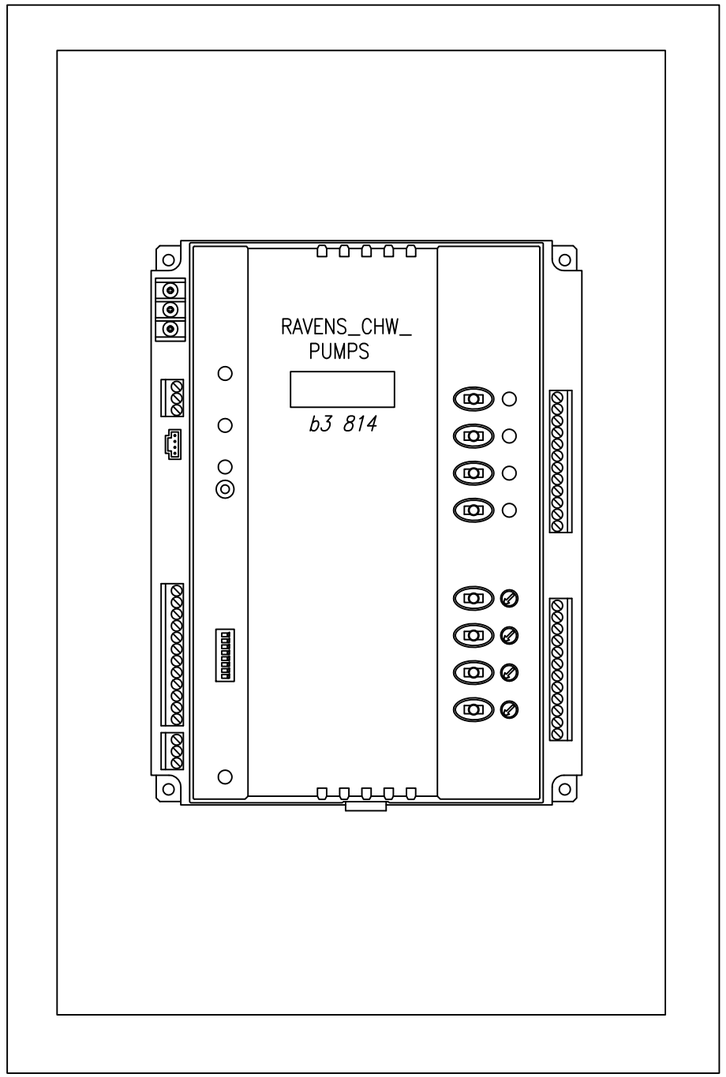
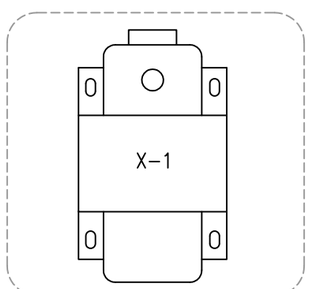
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 2.4 RAVENS_QD_AHU__Add_Bac. |

NEW 18" X 12" PANEL




EXISTING TRANSFORMER FOR CONTROLLER OUTPUTS AND b3 814 POWER FEED

| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| RAVENS_PUMPS | 1 | Andover | b3 814 | BACnet local controller |
| | 1 | Hoffman | HC18124P | Nema 1 hinged Cover enclosure w/ backplate |

Title

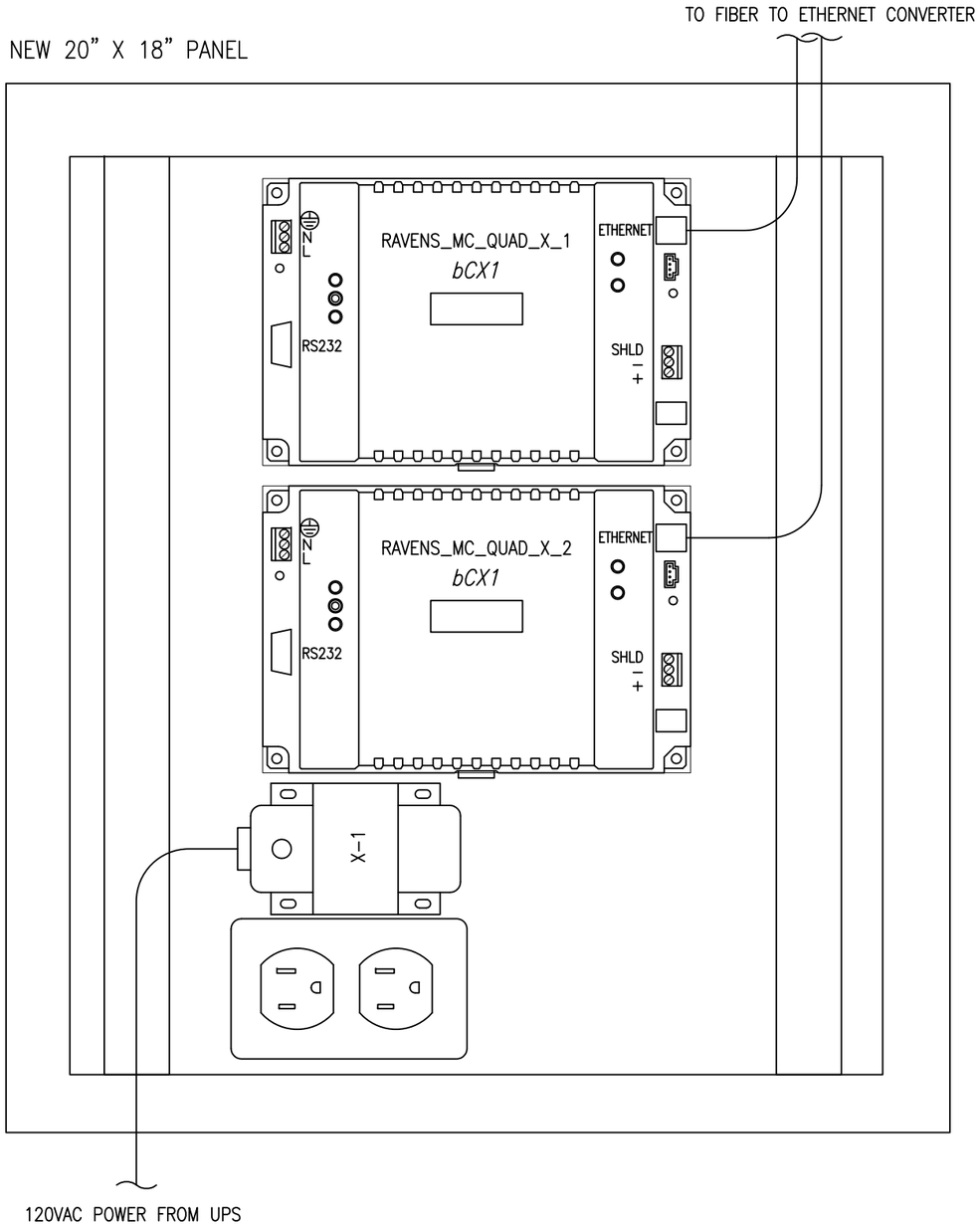
**RAVENS PUMPS PANEL**
**Located in Ravens Field**

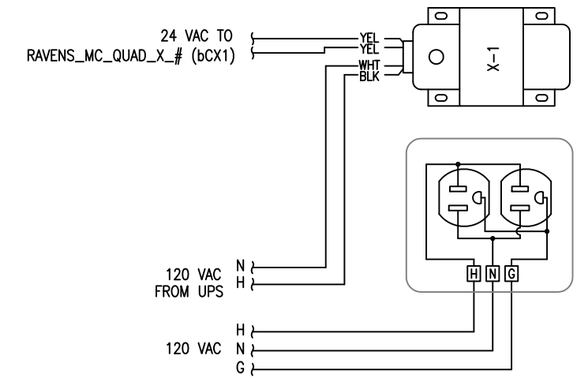
Project/Location

M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 3.1 Ravens_Pumps_Panel |




(Typical for 4)

| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| RAVENS_MC_QUAD_X_# | 2 | Andover | bCX1-CR-32 | BACnet controller/router |
| | 1 | Kele | RET2018ULP | Controls enclosure, w/ perf panel |
| | 1 | Kele | PRK | Panel receptacle assembly |
| | 2 | Panduit | F1X3WH6 w/ C1WH6 | 1" wide wire duct |
| X-1 | 1 | Veris | X050CBA | Control transformer,120/240/277/480V~24V, 50VA |

LOCATED IN OR NEAR THE FOLLOWING ROOMS WHERE NETWORK ACCESS IS AVAILABLE:

T.V./A.V. 6.03.09 (QUAD A)
T.V./A.V. 6.24.11 (QUAD B)
T.V./A.V. 6.30.10 (QUAD C)
T.V./A.V. 6.51.10 (QUAD D)

Title
**RAVENS UPPER SUITE BCX PANEL**
**Typical for 4 (Quads A – D)**

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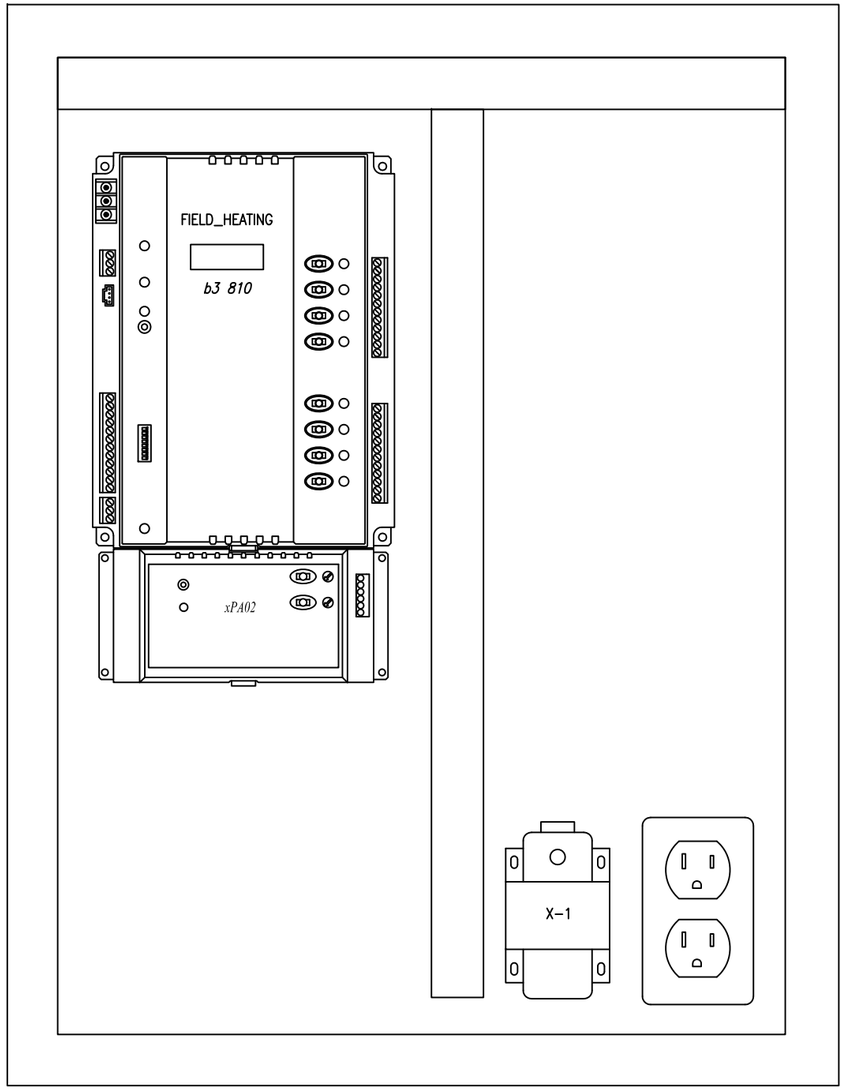
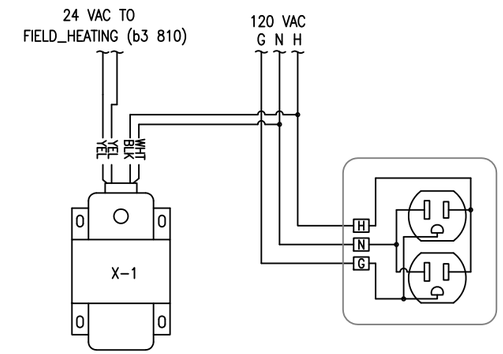
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 3.2 RAVENS_Upper_Suite_BCX_P. |

NEW 26" X 20" PANEL




| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| FIELD_HEATING | 1 | Andover | b3 810 | BACnet local controller |
| " | 1 | Andover | xP AO2 | Expansion Module |
| | 1 | Kele | RET2620 | Controls enclosure, w/ perf panel |
| | 1 | Kele | PRK | Panel receptacle assembly |
| | 2 | Panduit | F1X3WH6 w/ C1WH6 | 1" wide wire duct |
| X-1 | 1 | Veris/TAC | T-208 | Control transformer,120V~24V, 100VA |

Title
RAVENS FIELD HEATING PANEL
Located in Field Maint. Rm. 1.12.01

Project/Location
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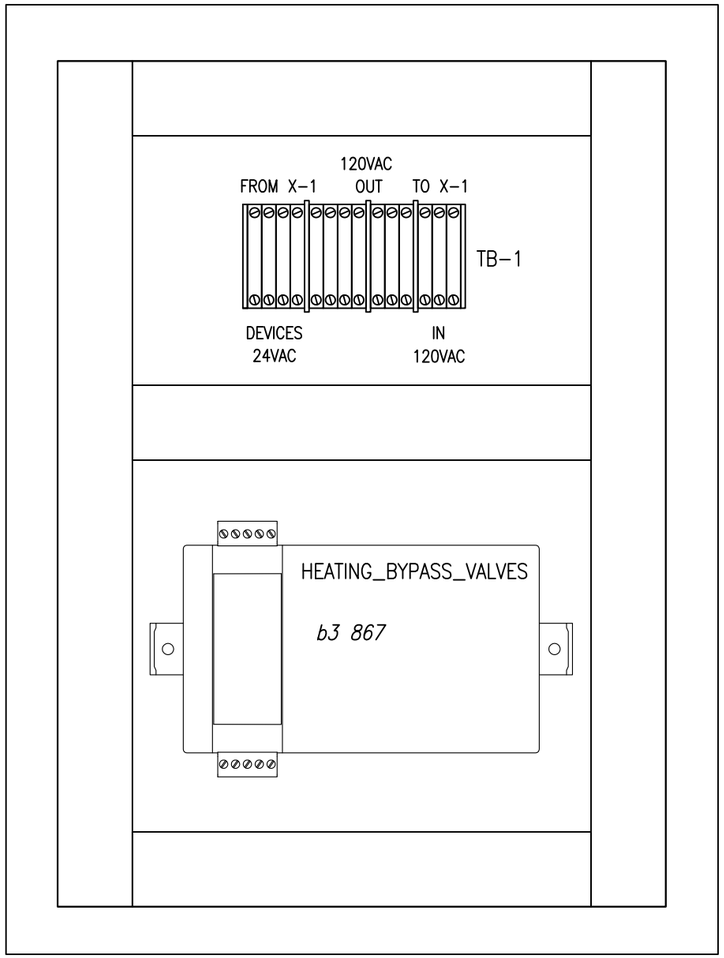
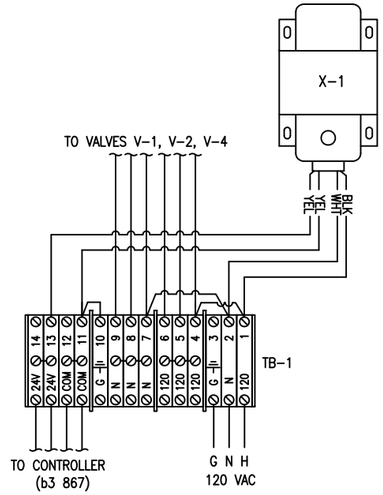
ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

PM: EK | Engineer: BH

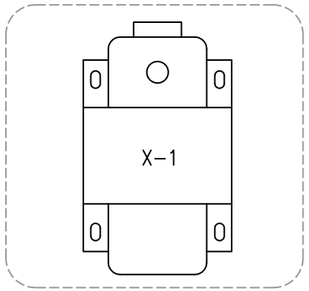
Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 3.3 RAVENS_Field_Heating_Panel

NEW 16" X 12" PANEL




NEW 50 VA TRANSFORMER FOR CONTROLLER OUTPUTS AND b3 867 POWER FEED




| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| HEATING_BYPASS_VALVES | 1 | Andover | b3 867 | Bacnet terminal controller |
| | 1 | Hoffman | HC16124P | Nema 1 hinged Cover enclosure w/ backplate |
| | 1 | Veris/TAC | X050CBA | Control transformer, 50 VA, w/ circuit breaker |
| | - | Kele | DIN-3F | DIN Rail |
| | 1 | Panduit | F1X3WH6 w/ C1WH6 | 1.26"W x 3.12"H wire duct w/ cover |
| TB-1 | - | Phoenix | UK5 series | terminal blocks & accessories |

Title
RAVENS
HEATING BYPASS VALVES PANEL

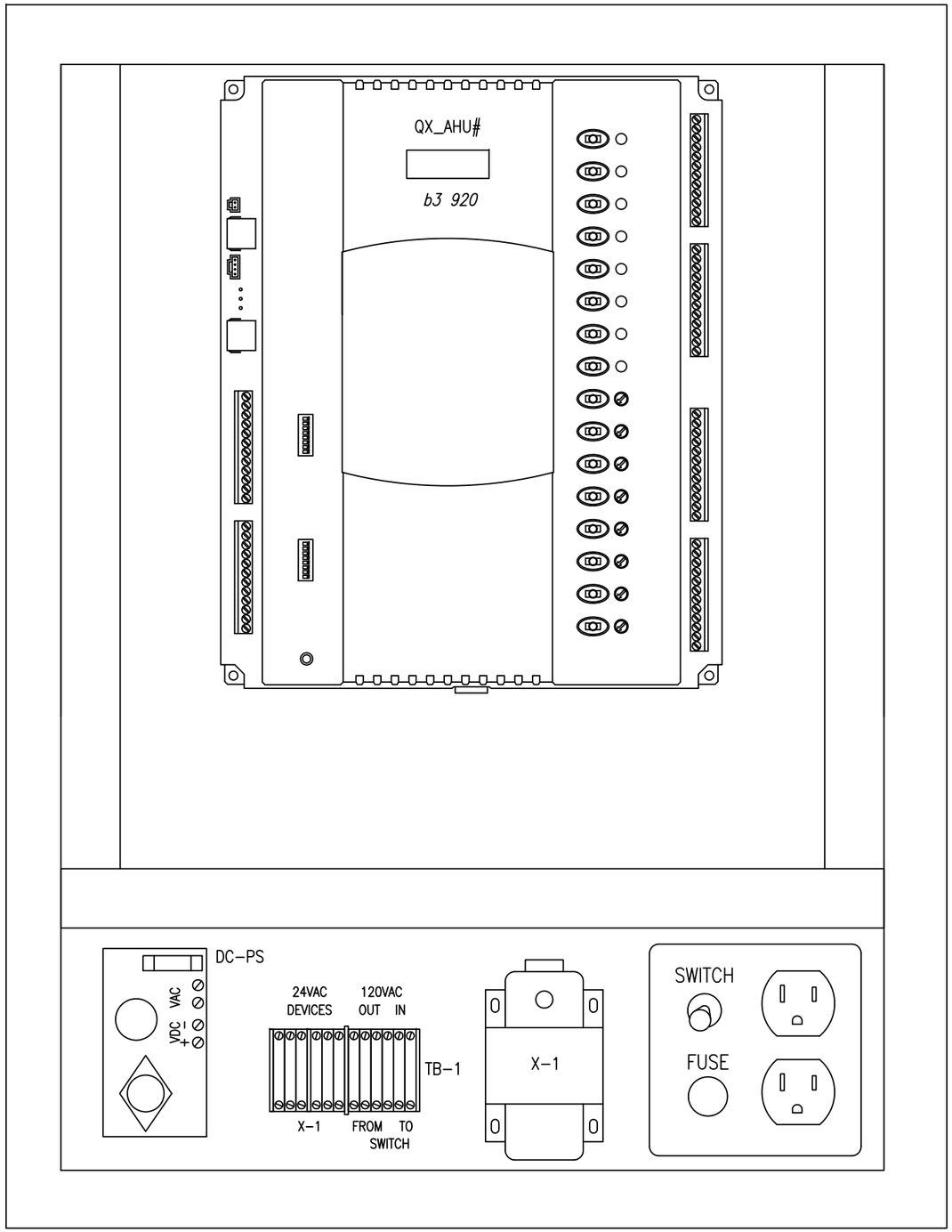
Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

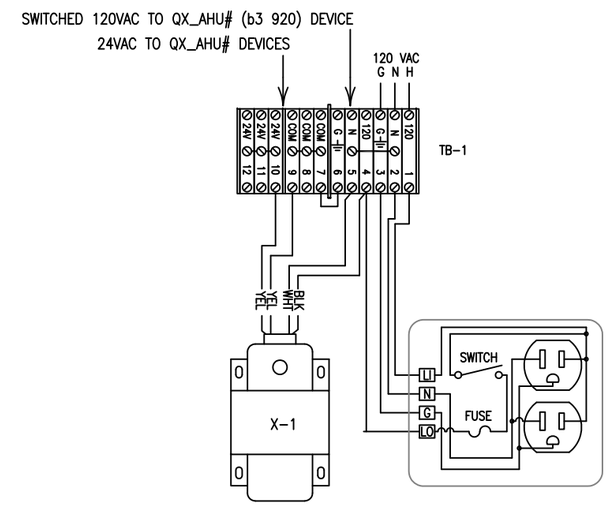
PM: EK
Engineer: BH

| Asbuilt | Job # | Dwg. Name |
|---|---|---|
| 11/22/10 | 4828 | 3.4 RAVENS HEATING BYPASS P. |

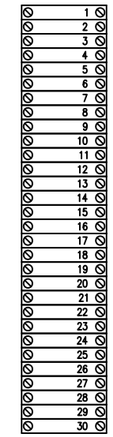
NEW 26" X 20" PANEL




LOCATED NEAR EXISTING JOHNSON AHU CONTROLLER




JOHNSON EXISTING TB SEE DRAWING 5.1



(Typical for 5)

| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| QX-AHU# | 1 | Andover | b3 920 | BACnet system controller |
| | 1 | Kele | RET2620 | Nema 1 enclosure, with panel plate |
| | 1 | Kele | PRK-FS | Panel receptacle & disconnect |
| | 2 | Kele | GF-1S | Fuse 1 amp slow-blow |
| DC-PS | 1 | Kele | DCP-1.5-W | 24VAC~24VDC Power Supply |
| | 1 | Kele | DIN-3F | DIN Rail |
| | 2 | Panduit | F1X3WH6 w/ C1WH6 | 1.26"W x 3.12"H wire duct w/ cover |
| X-1 | 1 | Veris/TAC | T-208 | Control transformer,120V~24V, 100VA |
| TB-1 | - | Phoenix | UK5 series | terminal blocks & accessories |

Title

**Typical VAV AHU Panel**
**Typical for AHU-1 through 4 & 9**

Project/Location

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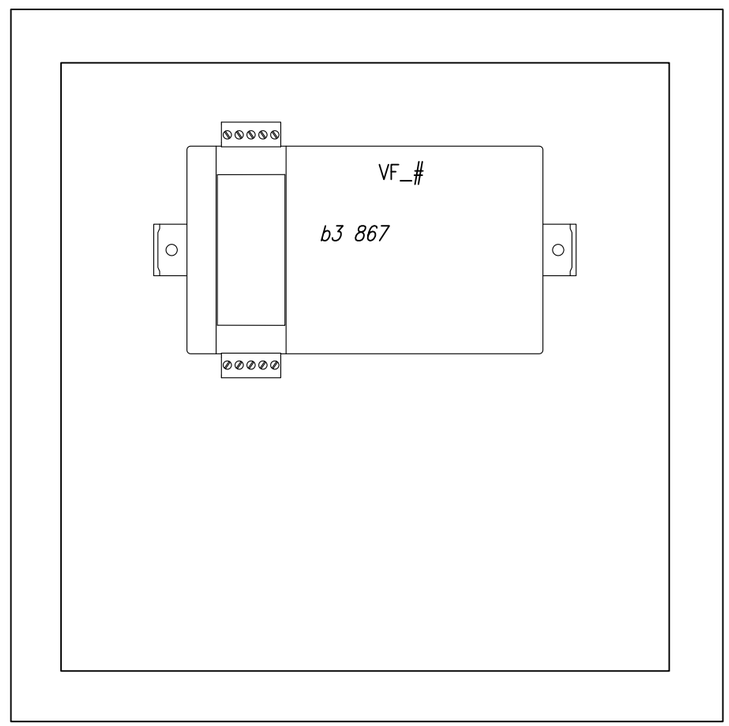
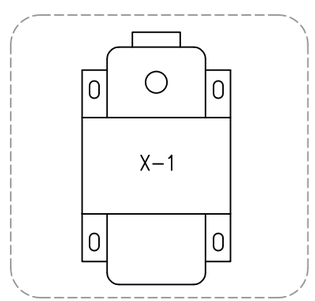
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 3.5 Typical VAV AHU Panel |

| Panels | Panel Location | Level |
|---|---|---|
| VF-9 | North Mech. Rm. A | Service - A |
| VF-26A & B | Electric Room | Press-A |
| VF-27A& B | Electric Room | Press-B |
| VF-28A & B | Electric Room | Press-C |
| VF-29A & B | Electric Room | Press-D |

NEW 12" X 12" PANEL




NEW 50 VA TRANSFORMER FOR CONTROLLER OUTPUTS AND b3 867 POWER FEED

Typical of 5 Panels

| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| VF_# | 1 | Andover | b3 867 | BACnet terminal controller |
| | 1 | Hoffman | HC12124P | Nema 1 hinged Cover enclosure w/ backplate |
| X-1 | 1 | Veris/TAC | X050CBA | Control transformer, 50 VA, w/ circuit breaker |

Title
RAVENS TYPICAL VF UNIT PANEL
(Typical of 5 Panels)

Project/Location
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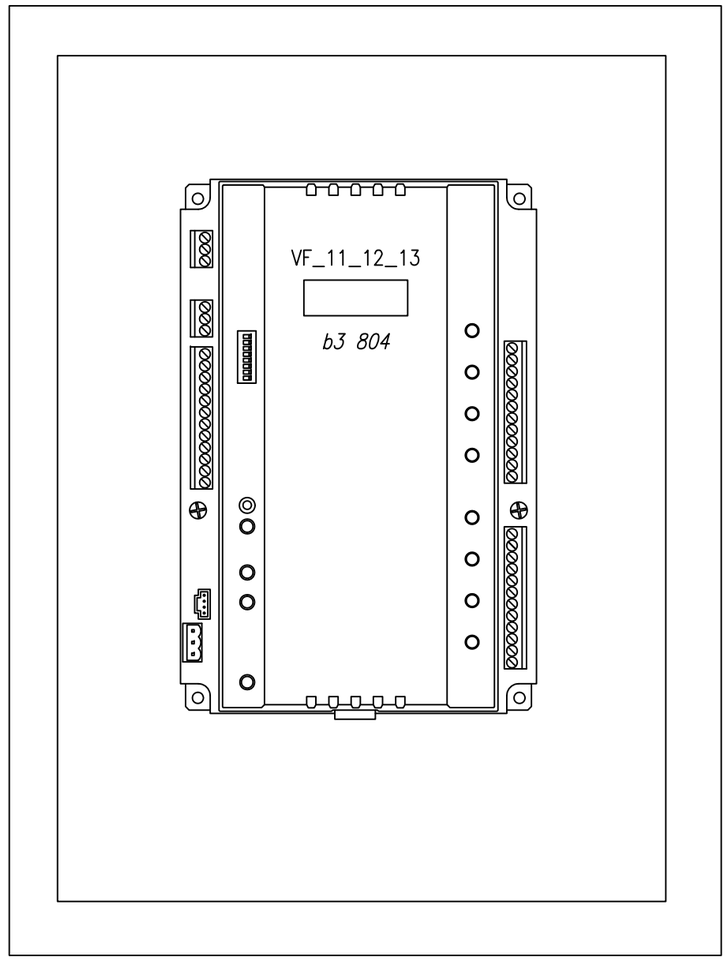
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

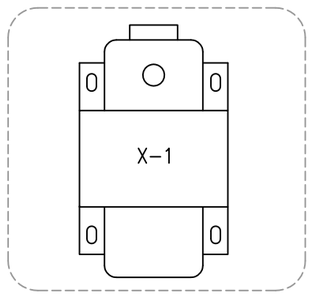
PM: EK | Engineer: BH

| Asbuilt | Job # | Dwg. Name |
|---|---|---|
| 11/22/10 | 4828 | 3.6 RAVENS_VF_UNIT_Panel |

| Panels | Panel Location | Level |
|---|---|---|
| VF-11,12,13 | South Mech. Rm. B | Service - B |

NEW 16" X 12" PANEL




NEW 50 VA TRANSFORMER FOR CONTROLLER OUTPUTS AND b3 804 POWER FEED

| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| VF_11_12_13 | 1 | Andover | b3 804 | BACnet local controller |
| | 1 | Hoffman | HC16124P | Nema 1 hinged Cover enclosure w/ backplate |
| X-1 | 1 | Veris/TAC | X050CBA | Control transformer, 50 VA, w/ circuit breaker |

Title
RAVENS
VF-11,12,13 PANEL

Project/Location
M&T BANK STADIUM (RAVENS)
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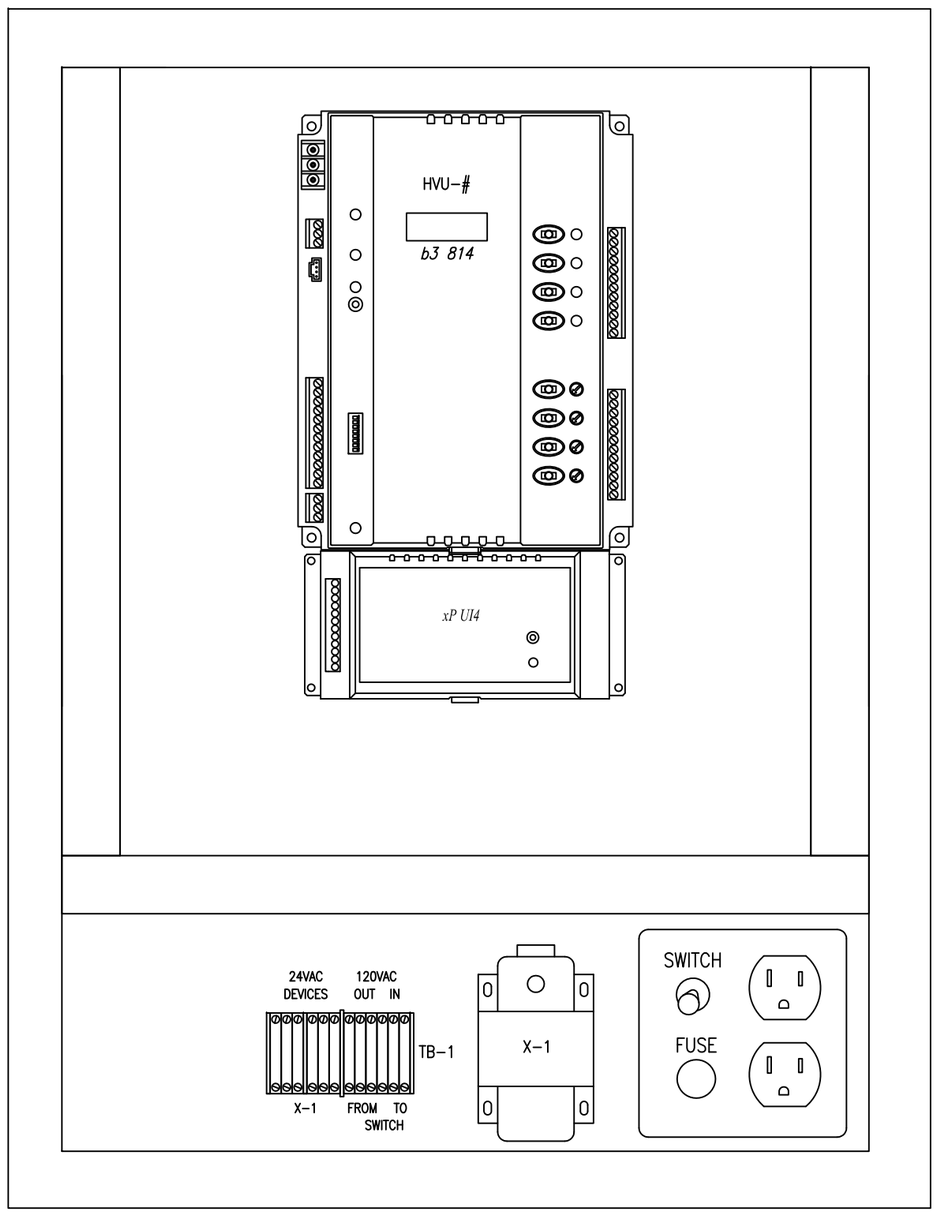
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

PM: EK | Engineer: BH

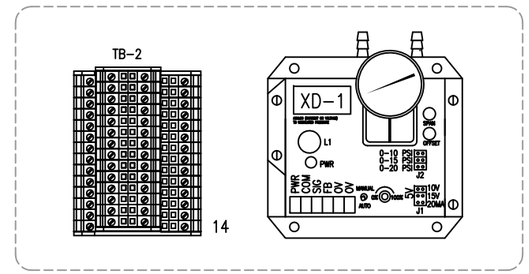
| Asbuilt | Job # | Dwg. Name |
|---|---|---|
| 11/22/10 | 4828 | 3.7 RAVENS_VF_11_12_13_Panel |

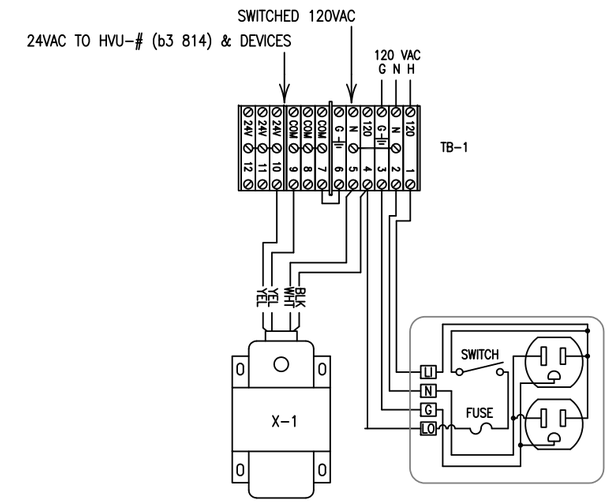
NEW 26" X 20" PANEL




PANEL LOCATED NEAR EXISTING JOHNSON HVU PANEL

NEW DEVICES/PARTS INSTALLED
IN EXISTING HVU PANEL




(Typical for 2)

| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| HVU-# | 1 | Andover | b3 814 | BACnet local controller |
| " | 1 | Andover | xP UI4 | Expansion Module |
| XD-1 | 1 | ACT | EPC2GFSB | Analog Current or Voltage Input to Pneumatic Output including Fail Safe |
| | 1 | Kele | RET2620 | Nema 1 enclosure, with panel plate |
| | 1 | Kele | PRK-FS | Panel receptacle & disconnect |
| | 2 | Kele | GF-1S | Fuse 1 amp slow-blow |
| | - | Kele | DIN-3F | DIN Rail |
| | 2 | Panduit | F1X3WH6 w/ C1WH6 | 1.26"W x 3.12"H wire duct w/ cover |
| X-1 | 1 | Veris/TAC | T-208 | Control transformer,120V~24V, 100VA |
| TB-1,2 | - | Phoenix | UK5/UTTB series | terminal blocks & accessories |

Title
NEW HVU-# Panel
(Typical for 2: HVU-1 & 2)

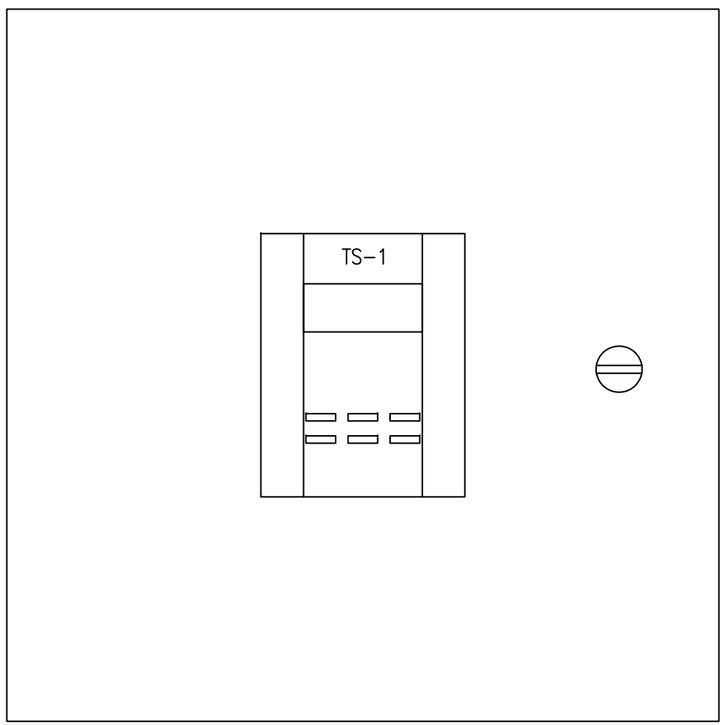
Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

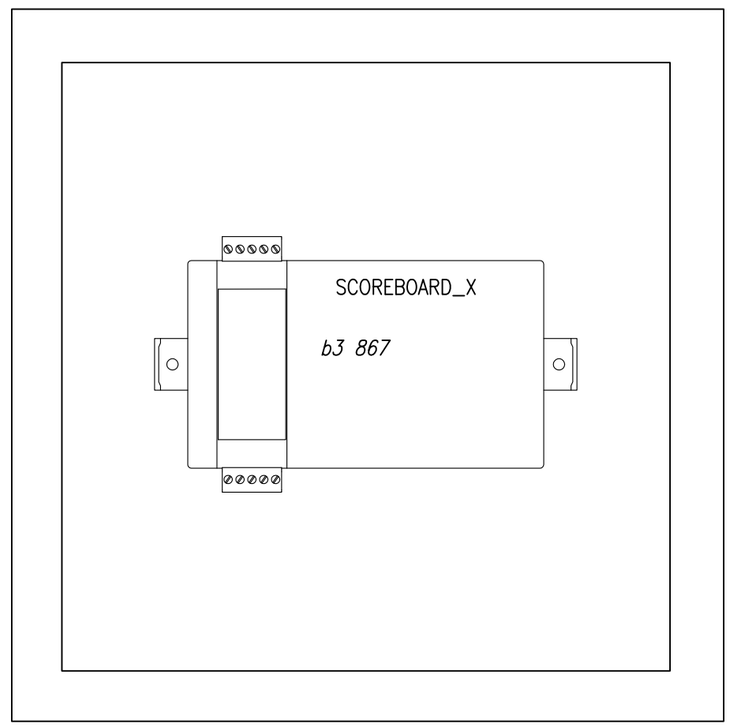
| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 3.8 HVU-1 & 2 Panel |

NEW 12" X 12" PANEL

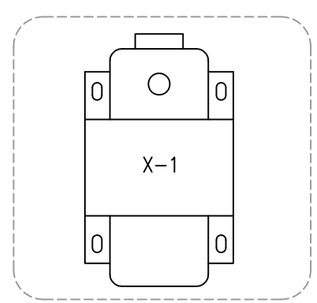
FRONT OF ENCLOSURE




INSIDE ENCLOSURE




NEW 50 VA TRANSFORMER FOR CONTROLLER OUTPUTS AND b3 867 POWER FEED




Typical of 2 Panels

| Tag | Qty. | Mfg. | Model | Description |
|---|---|---|---|---|
| SCOREBOARD_X | 1 | Andover | b3 867 | Bacnet terminal controller |
| | 1 | Hoffman | HC12124P | Nema 1 hinged Cover enclosure w/ backplate |
| TS-1 | 1 | TAC | TTS-SD-LCD-1 | Smart Sensor w/ LCD |
| X-1 | 1 | Veris/TAC | X050CBA | Control transformer, 50 VA, w/ circuit breaker |

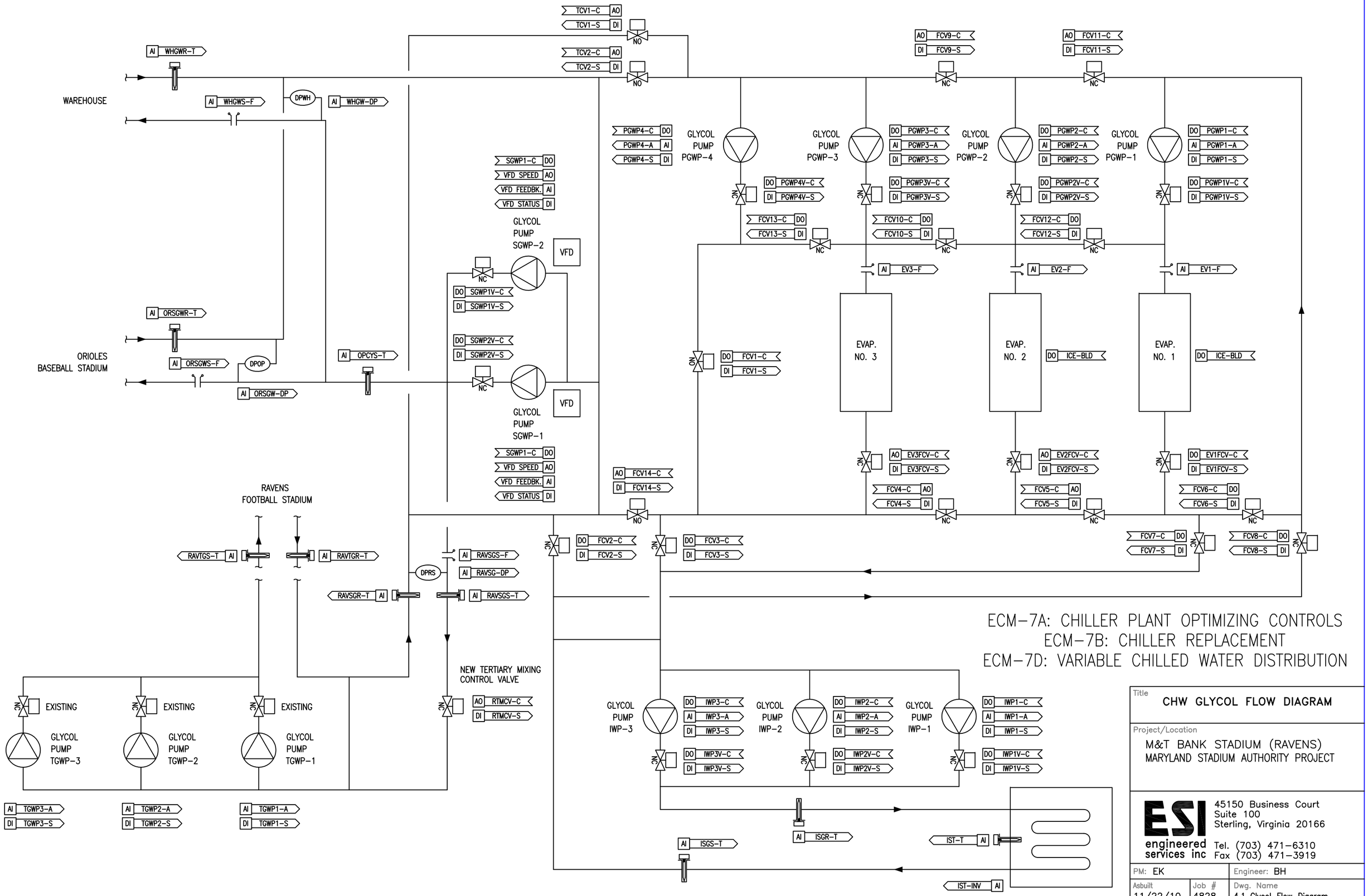
Title
RAVENS Scoreboard EFs Panel
(Typical of 2 Panels, EAST & WEST)

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

PM: EK | Engineer: BH

Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 3.9 Ravens Scoreboard EFs Pnls



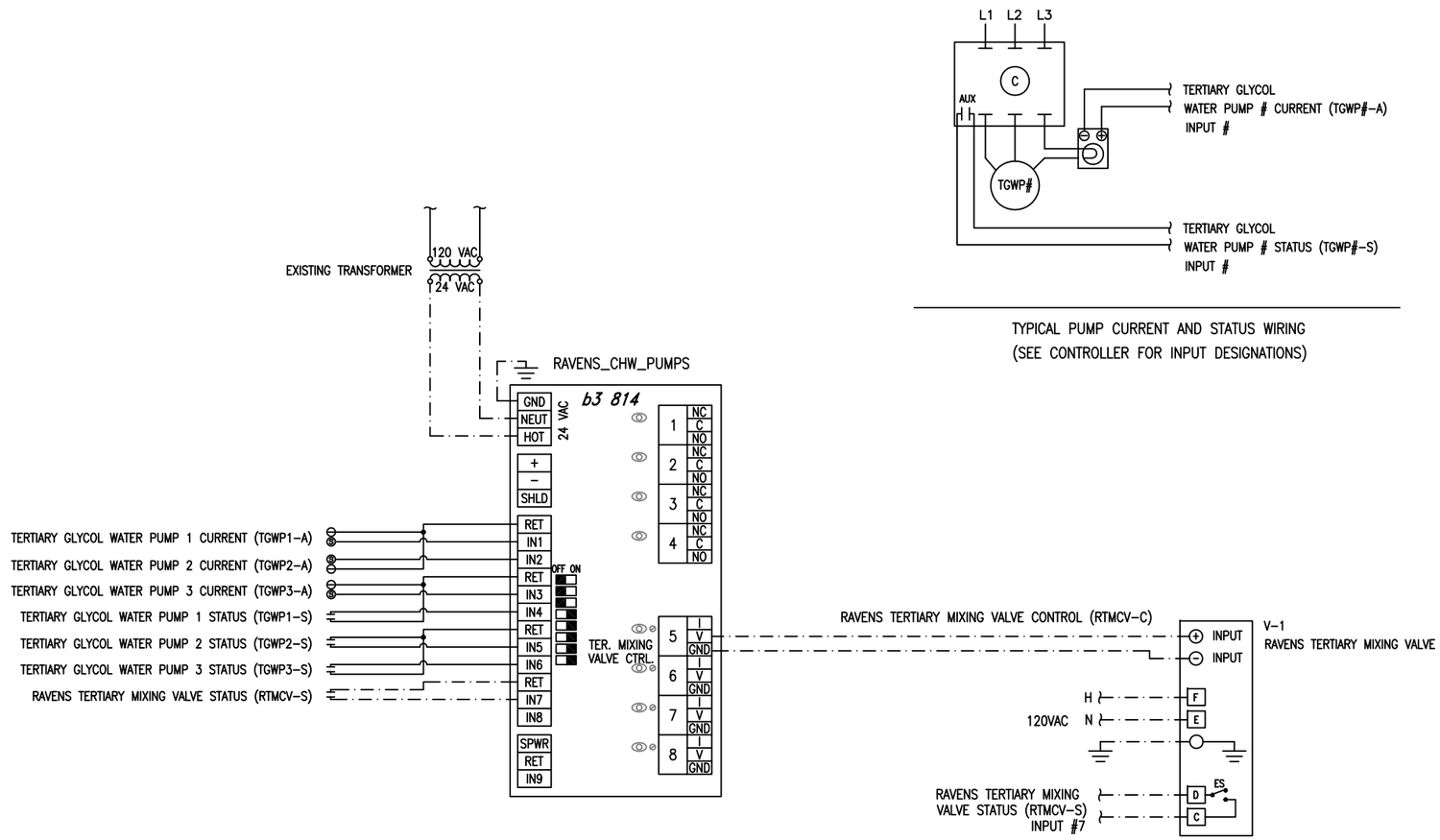

Title
**CHW GLYCOL FLOW DIAGRAM**

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 4.1 Glycol_Flow_Diagram |

# ECM-7A: CHILLER PLANT OPTIMIZING CONTROLS




| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| V-1 | 1 | TAC | See schedule | 2-10vdc | 2-way 120V modulating non-spring return butterfly valve |

= EXISTING WIRING

= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

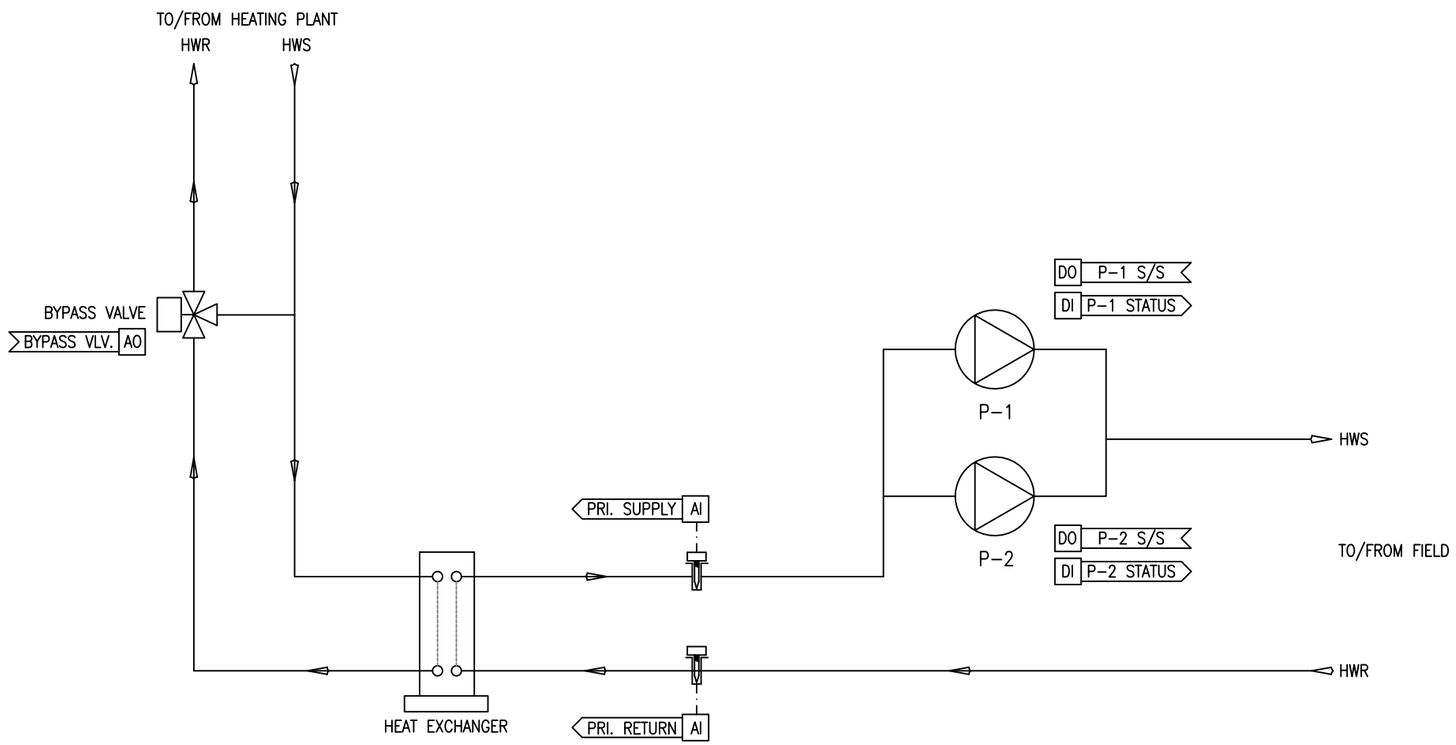
Title
RAVENS CHW PUMPS
Hardwired Points

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 4.2 RavensPumpsWire |

# ECM-8E: HEATING CONTROLS UPGRADE AT RAVENS STADIUM



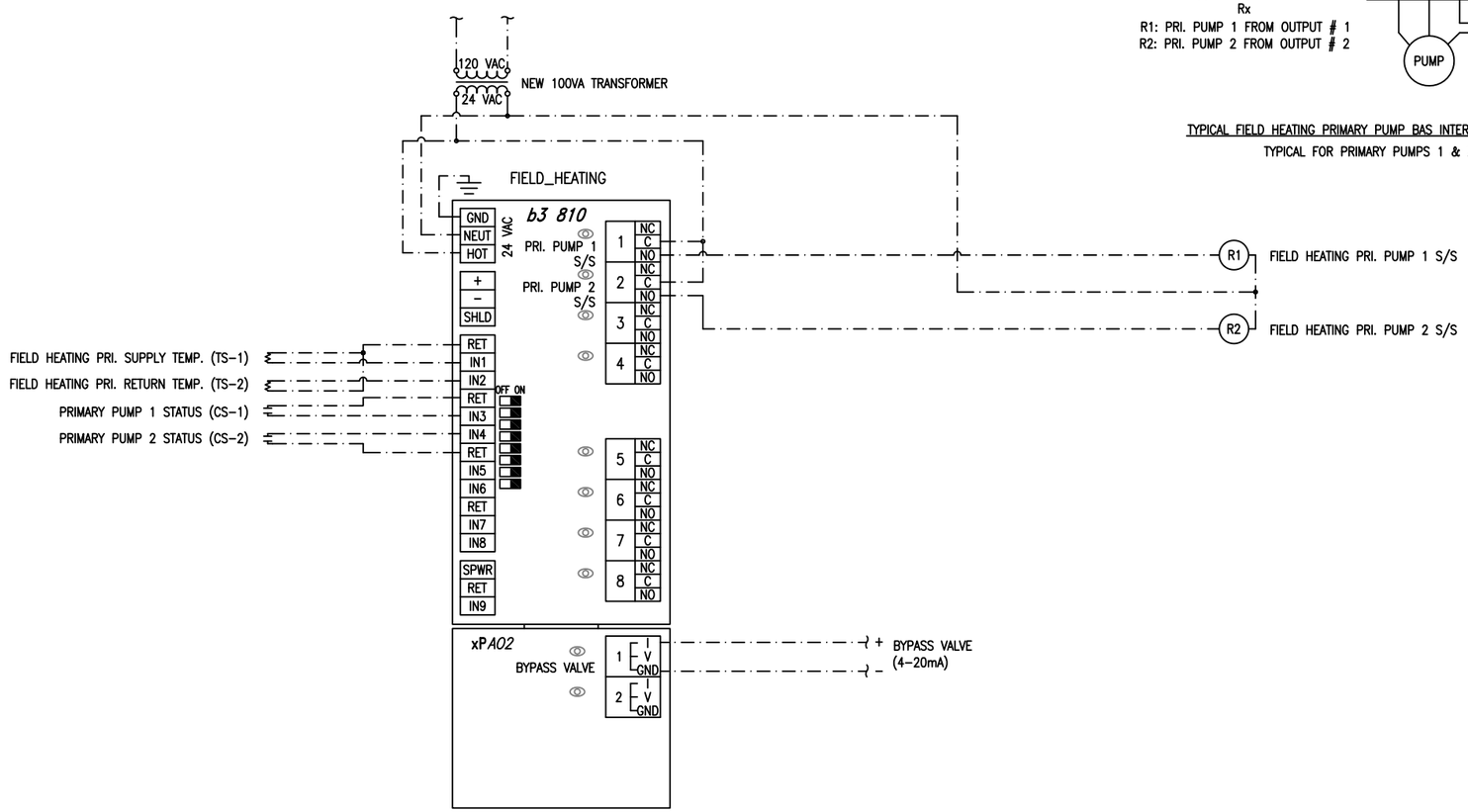

Title
**FIELD HEATING UPGRADE**
**Flow Diagram**

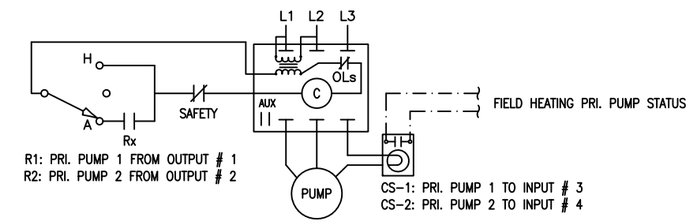
Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 4.3 RAVENS_Field_Heating_Flow |

# ECM–8E: HEATING CONTROLS UPGRADE AT RAVENS STADIUM




TYPICAL FIELD HEATING PRIMARY PUMP BAS INTERLOCK WIRING

TYPICAL FOR PRIMARY PUMPS 1 & 2

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| TS-1,2 | 2 | Mamac | TE-703-C-7-A-2 | -40°F to 210°F ± | Immersion temperature sensor, 4", 1/4" NPT thread adapter |
| " | 1 | Mamac | A-500-1-B-2 | - | Thermowell, 4" stainless steel, 1/4" NPT internal, 1/2" NPT external |
| CS-1,2 | 2 | Mamac | CT-810 | 1.0-200A adj. | Solid core adjustable setpoint current switch, max 150A continuous |
| R-1,2 | 2 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |

= EXISTING WIRING

= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

Title

FIELD HEATING UPGRADE
Hardwired Points

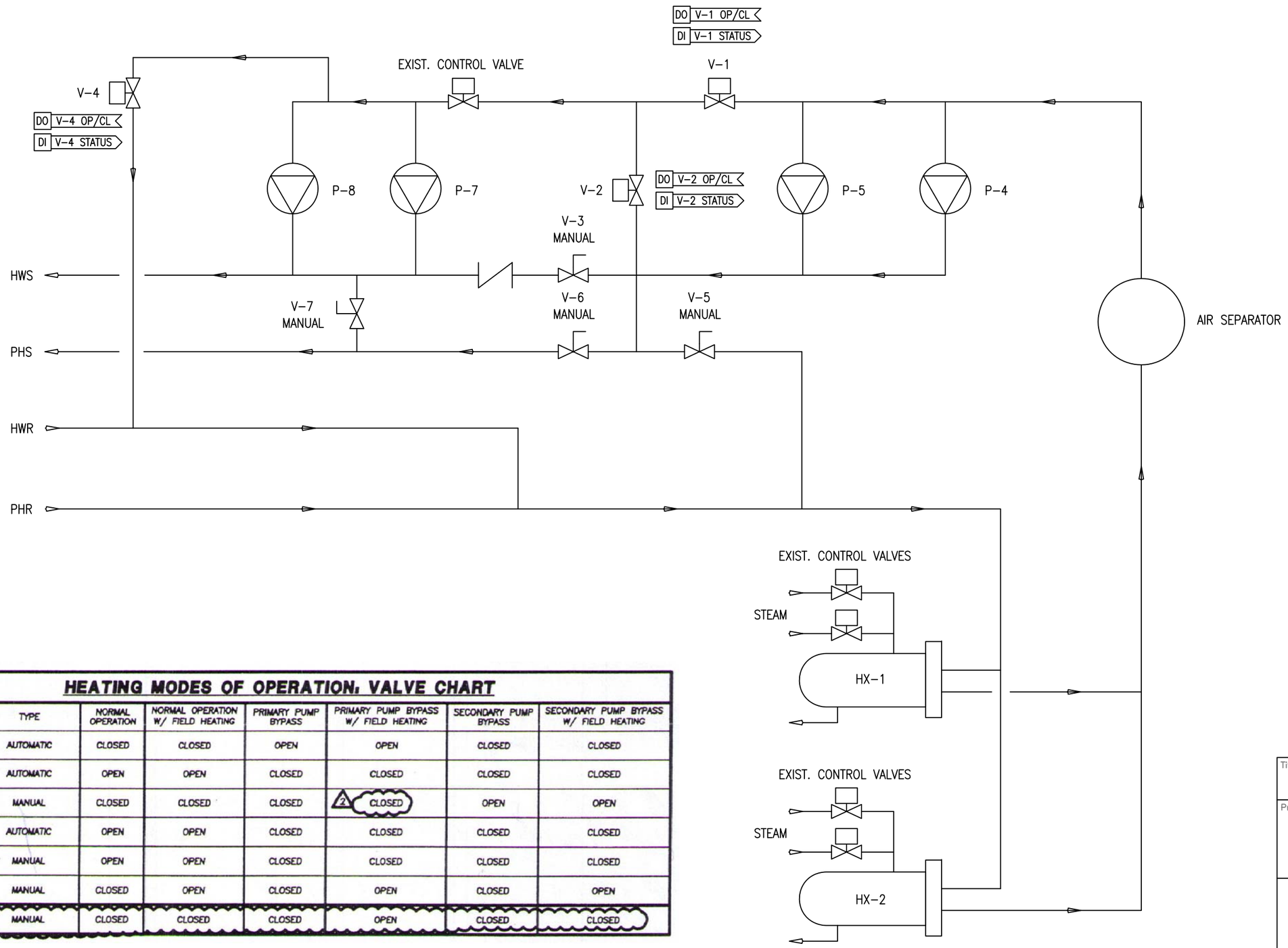
Project/Location

M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471–6310
Fax (703) 471–3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 4.4 RAVENS_Field_Heating_Wire |

# ECM-8E CO#2: CHANGE ORDER TO ADD 3 VALVES TO M&T HW SYSTEM




## HEATING MODES OF OPERATION: VALVE CHART

| VALVE | TYPE | NORMAL OPERATION | NORMAL OPERATION W/ FIELD HEATING | PRIMARY PUMP BYPASS | PRIMARY PUMP BYPASS W/ FIELD HEATING | SECONDARY PUMP BYPASS | SECONDARY PUMP BYPASS W/ FIELD HEATING |
|---|---|---|---|---|---|---|---|
| V-1 | AUTOMATIC | CLOSED | CLOSED | OPEN | OPEN | CLOSED | CLOSED |
| V-2 | AUTOMATIC | OPEN | OPEN | CLOSED | CLOSED | CLOSED | CLOSED |
| V-3 | MANUAL | CLOSED | CLOSED | CLOSED | 2 CLOSED | OPEN | OPEN |
| V-4 | AUTOMATIC | OPEN | OPEN | CLOSED | CLOSED | CLOSED | CLOSED |
| EX. V-5 | MANUAL | OPEN | OPEN | CLOSED | CLOSED | CLOSED | CLOSED |
| EX. V-6 | MANUAL | CLOSED | OPEN | CLOSED | OPEN | CLOSED | OPEN |
| V-7 | MANUAL | CLOSED | CLOSED | CLOSED | OPEN | CLOSED | CLOSED |

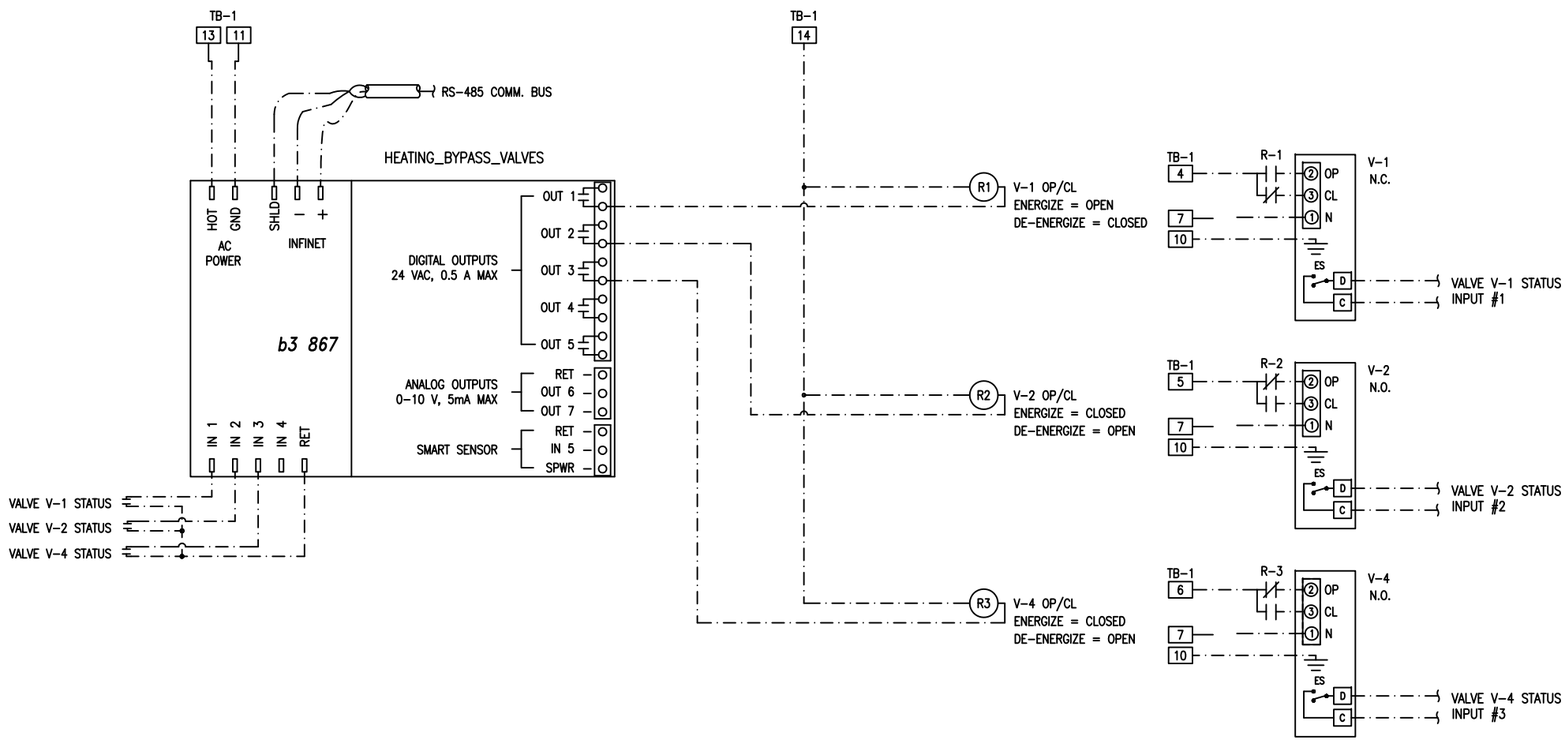
Title
HEATING WATER PLANT
Flow Diagram

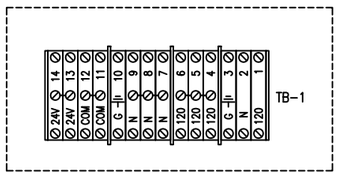
Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 4.5 HW Plant Flow Diagram |

# ECM-8E CO#2: CHANGE ORDER TO ADD 3 VALVES TO M&T HW SYSTEM




SEE PANEL DWG. 3.4 FOR POWER WIRING

= WIRING BY OTHERS

= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| R-1,2,3 | 3 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |
| V-1,2,4 | 3 | TAC | see schedule | 2-pos | 2-way 120V on/off non-spring return butterfly valve |

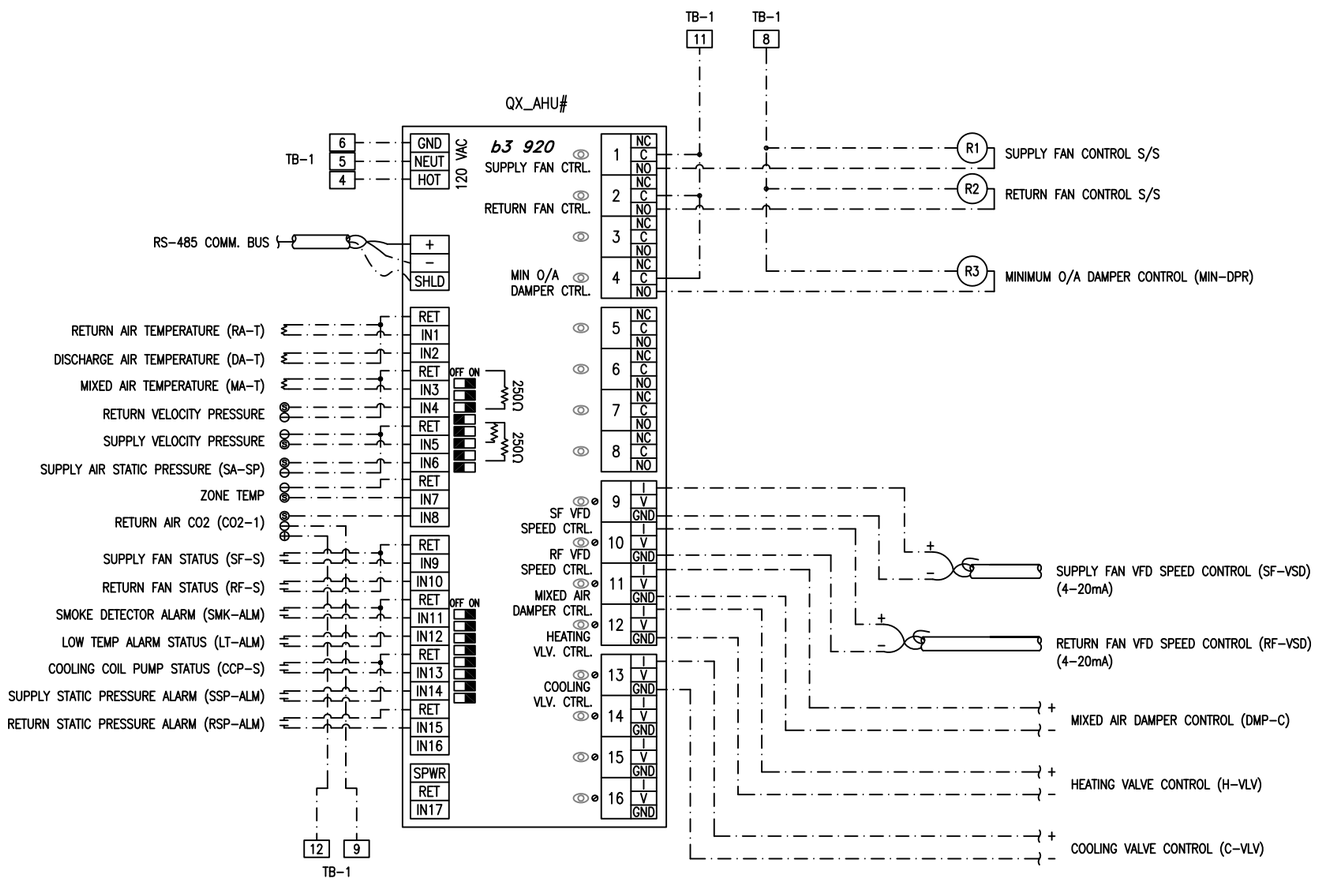
Title
**HEATING BYPASS VALVES**
**Hardwired Points**

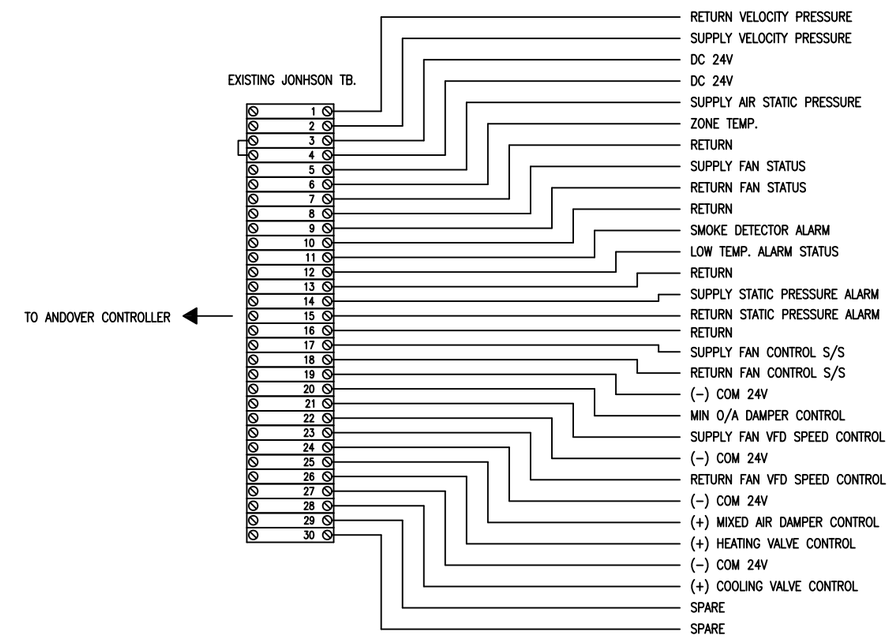
Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

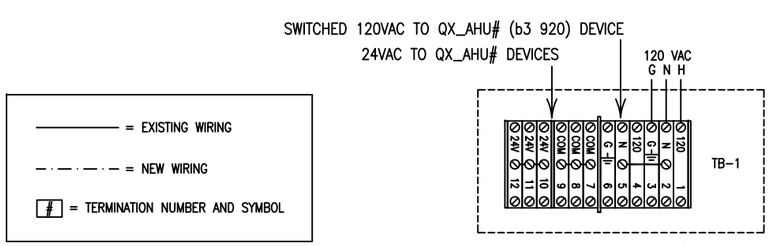

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | Engineer: BH | |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 4.6 RAVENS_Heating Byp. Valves |

# ECM-9D(II): DEMAND VENTILATION CONTROL ON AHUs AT RAVENS STADIUM – CONTROLLER REPLACEMENT REQUIRED




Typical for 4 Units

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| CO2-1 | 1 | TAC/AirTest | ATT-TR9292-B | 0-2000 ppm | Duct CO2 Transmitter, 0-10V or 4-20mA output |
| RA-T,DA-T | 2 | MAMAC | TE-702-B-7-C | -40°F to 210°F ± .4F° | Duct temperature probe sensor, 8", galvanized enclosure |
| MA-T | 1 | MAMAC | TE-707-B-7-B-2 | -40°F to 160°F ± .4F° | Duct averaging temperature sensor, 12', galvanized steel enclosure |

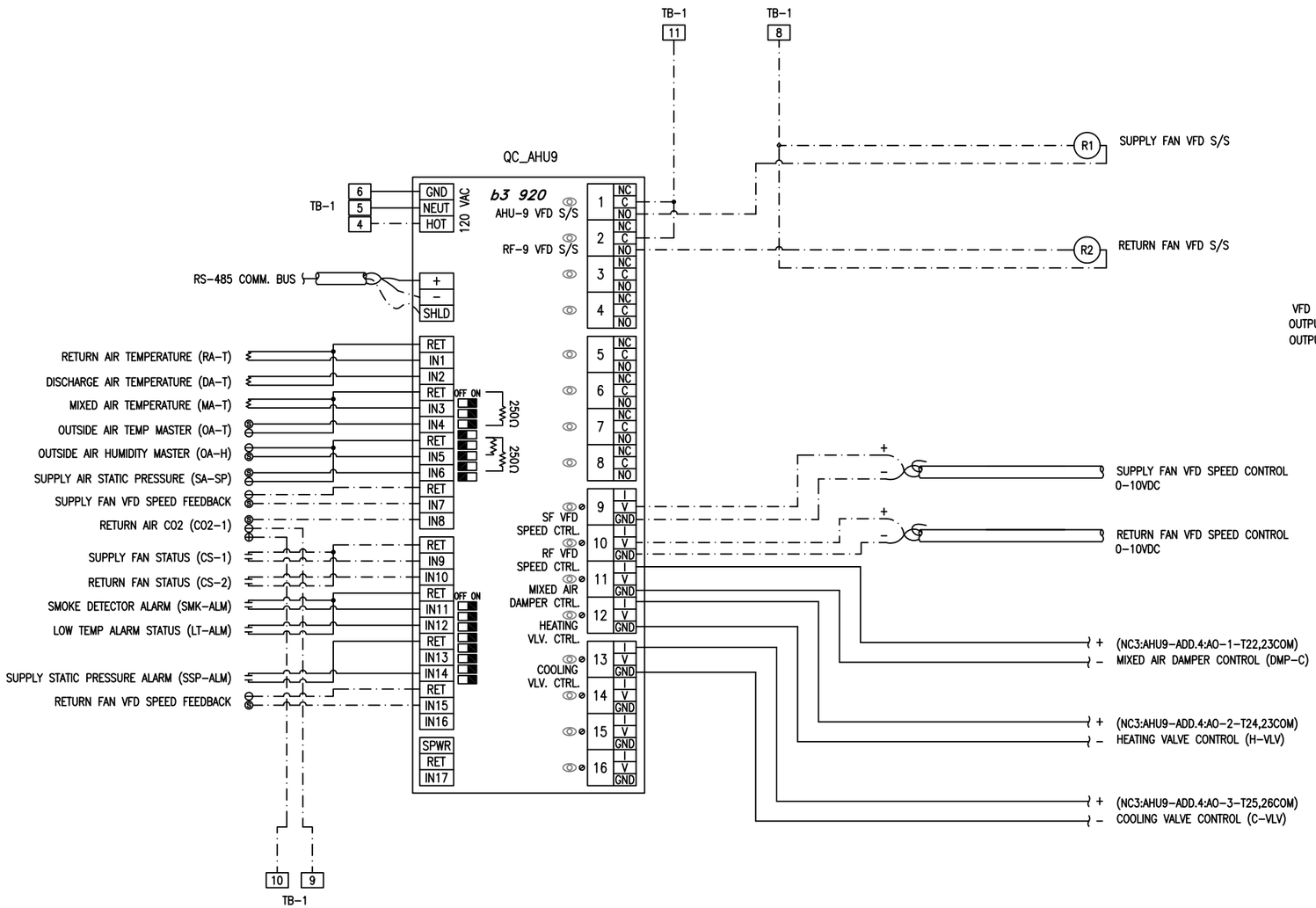
Title
AHU-1 THROUGH 4
ADDITIONS & NEW CONTROLLERS

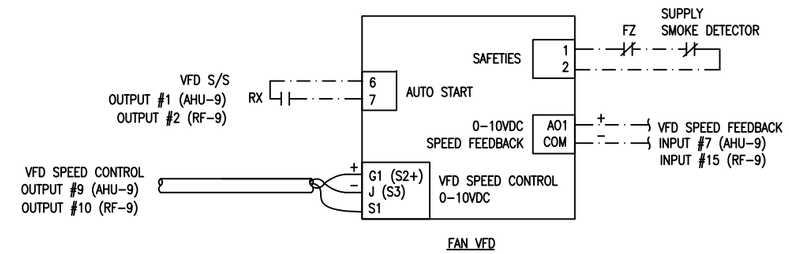
Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 5.1 RAVENS.AHU_UNIT_1-4_Add |

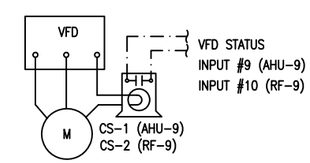
# ECM-9B(II): PROVIDE VFDs ON AHUs AT RAVENS STADIUM
# ECM-9D(II): DEMAND VENTILATION CONTROL ON AHUs AT RAVENS STADIUM – CONTROLLER REPLACEMENT REQUIRED



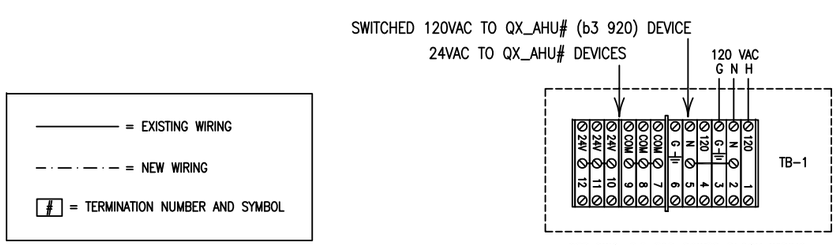

TYPICAL FAN VFD BAS INTERLOCK WIRING

TYPICAL FOR AHU-9 AND RF-9




TYPICAL FAN VFD STATUS WIRING

TYPICAL FOR AHU-9 AND RF-9




RAVENS.AHU_9 VFD Add

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| CS-1,2 | 2 | Veris | H904 | 3.5-135A | Split core current switch for VFDs |
| R-1,2 | 2 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |
| CO2-1 | 1 | TAC/AirTest | ATT-TR9292-B | 0-2000 ppm | Duct CO2 Transmitter, 0-10V or 4-20mA output |
| RA-T,DA-T | 2 | MAMAC | TE-702-B-7-C | -40°F to 210°F ± .4F° | Duct temperature probe sensor, 8", galvanized enclosure |
| MA-T | 1 | MAMAC | TE-707-B-7-B-2 | -40°F to 160°F ± .4F° | Duct averaging temperature sensor, 12', galvanized steel enclosure |

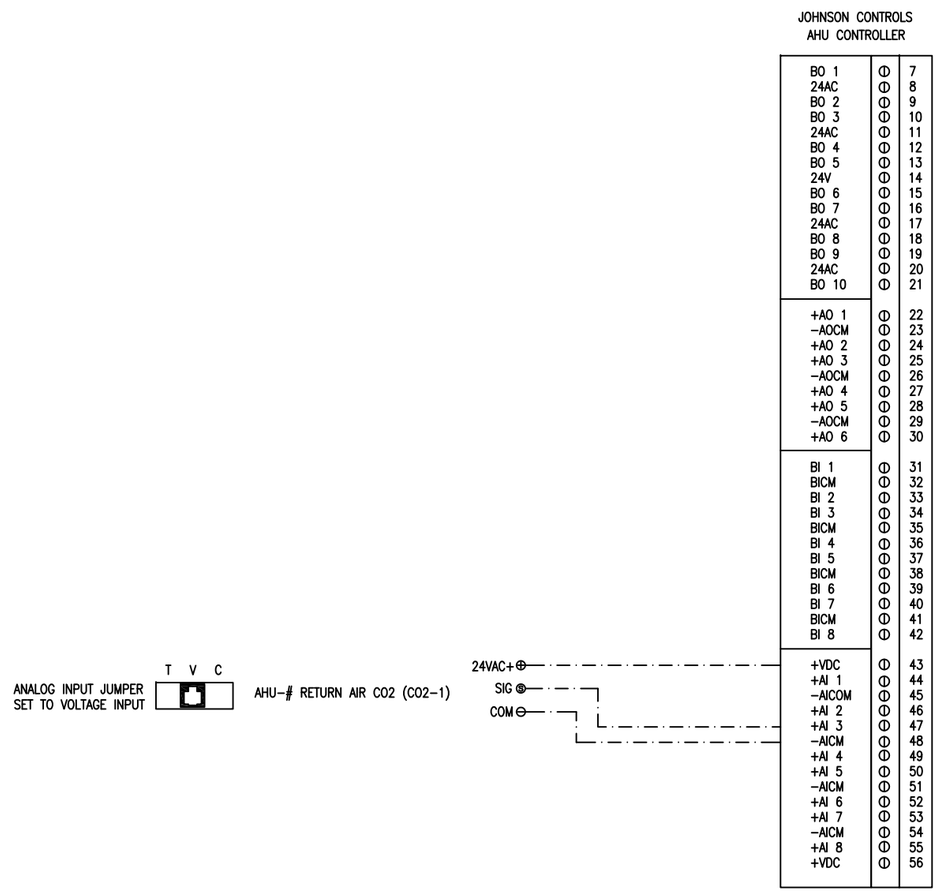
Title
AHU-9
ADDITIONS & NEW CONTROLLER

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

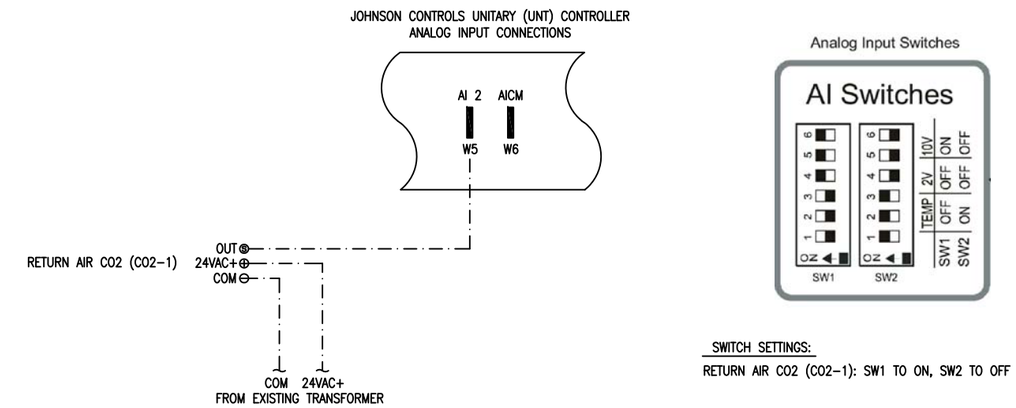

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 5.2 RAVENS.AHU_UNIT_9_Add |

# ECM-9D(II): DEMAND VENTILATION CONTROL ON AHUs AT RAVENS STADIUM



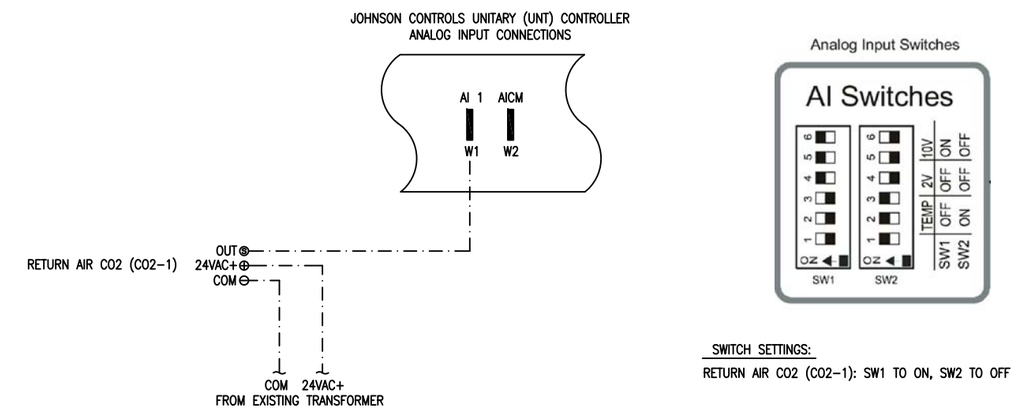

TYPICAL FOR AHU-11 & 12




SWITCH SETTINGS:

RETURN AIR CO2 (CO2-1): SW1 TO ON, SW2 TO OFF

TYPICAL FOR AHU-10 & 14




SWITCH SETTINGS:

RETURN AIR CO2 (CO2-1): SW1 TO ON, SW2 TO OFF

TYPICAL FOR AHU-15, 16 & 17

= EXISTING WIRING

= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

Typical for 7 Units

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| CO2-1 | 1 | TAC/AirTest | ATT-TR9292-B | 0-2000 ppm | Duct CO2 Transmitter, 0-10V or 4-20mA output |

Title

AHU-10-12, 14-17
CO2 ADDITION TO EXISTING JC

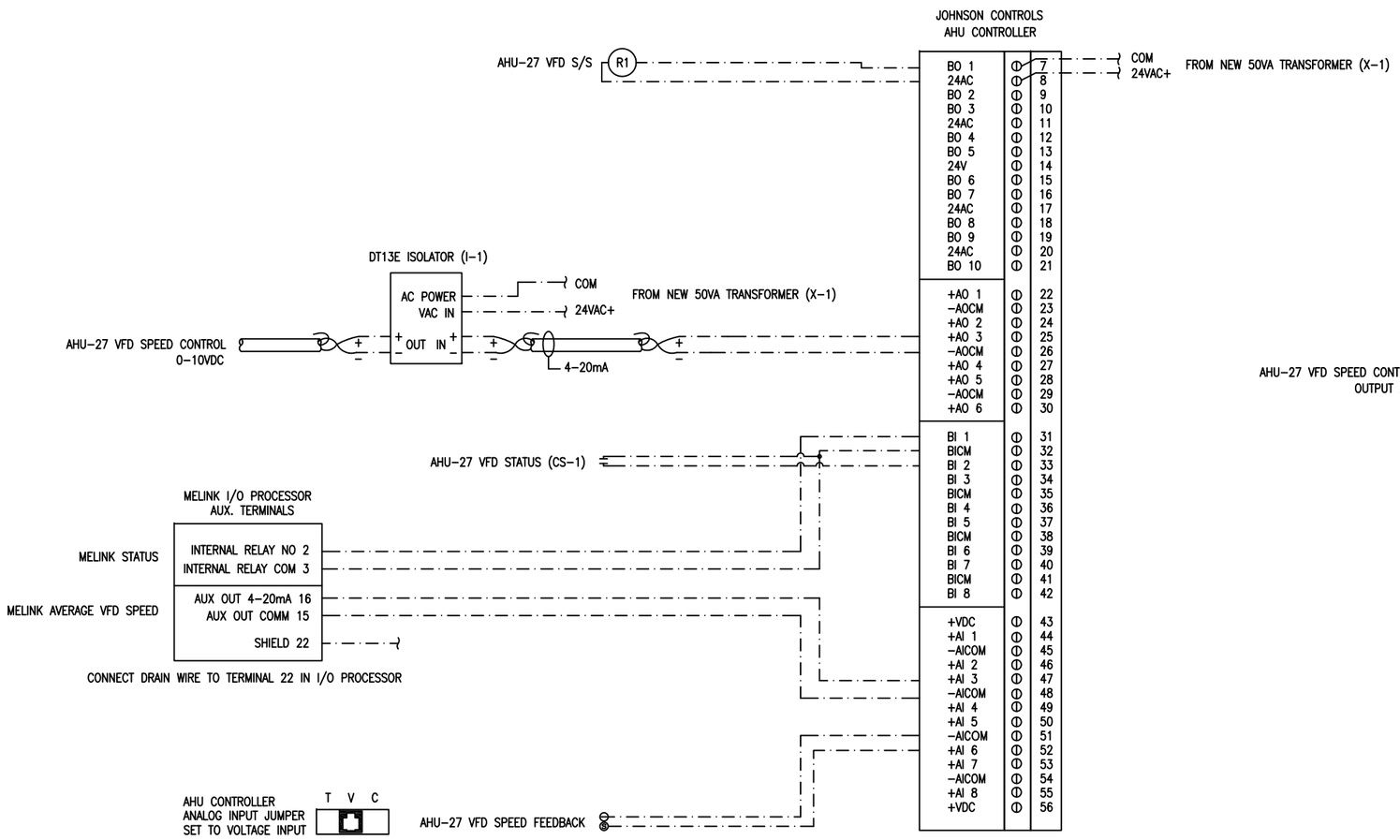
Project/Location

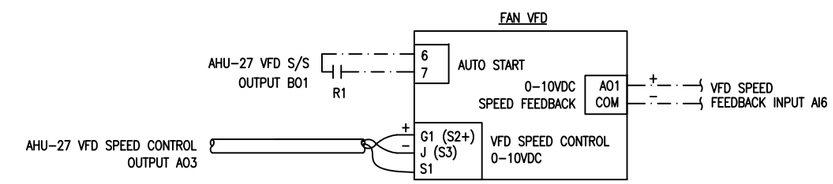
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

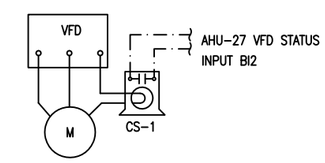

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 5.3 RAV.AHU_10-12_14-17_CO2 |

# ECM-9E(II): CONVERT RAVENS STADIUM MAIN KITCHEN HOODS TO VARIABLE VOLUME




FAN VFD BAS INTERLOCK WIRING




FAN VFD STATUS WIRING

= EXISTING WIRING

= NEW WIRING

= TERMINATION NUMBER AND SYMBOL

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| CS-1 | 1 | Veris | H904 | 3.5-135A | Split core current switch for VFDs |
| R-1 | 1 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |
| X-1 | 1 | Veris | X050CBA | 120/240/277/480V~ | Control transformer, 50 VA, w/ circuit breaker |
| I-1 | 1 | Kele | DT13E-24 | - | Isolated DC to DC Transmitter |

Title
AHU-27
VFD & MELINK ADD. TO EXISTING JC

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 5.4 RAVENS.AHU-27_Add |

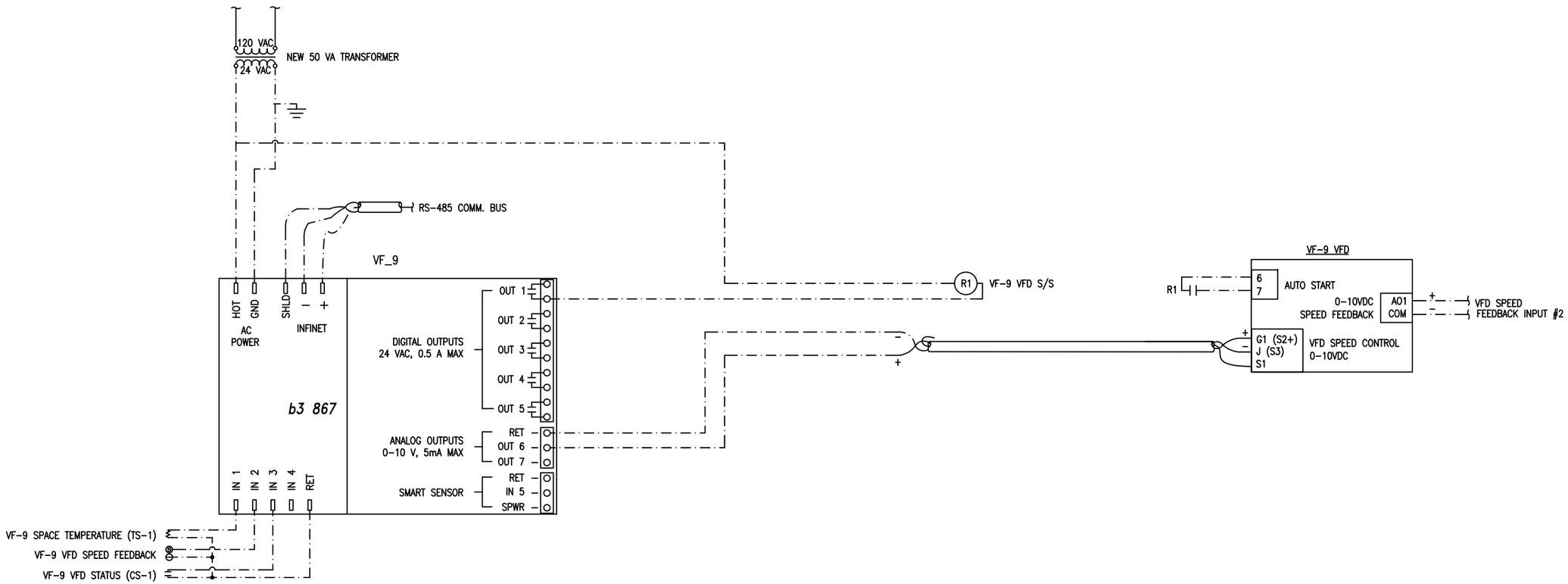
# ECM-9G: EMCS CONTROL OF EXHAUST FANS AT RAVENS STADIUM

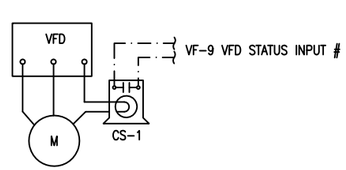
| Unit # | Service | Level |
|---|---|---|
| VF-9 | North Mech. Rm. A | Service - A |

= EXISTING WIRING

= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL




VF-9 VFD FAN STATUS WIRING

SEE DWG. 3.6 FOR PANEL LAYOUT AND BILL OF MATERIALS

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| TS-1 | 1 | Mamac | TE-205-EX-7-0 | 32°F to 158°F | Space temp. sensor |
| R-1 | 1 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |
| CS-1 | 1 | Veris | H904 | 3.5-135A | Split core current switch for VFDs |

Title

VF-9 VFD
Hardwired Points

Project/Location

M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 6.1 RAVENS VF-9 VFD Wiring |

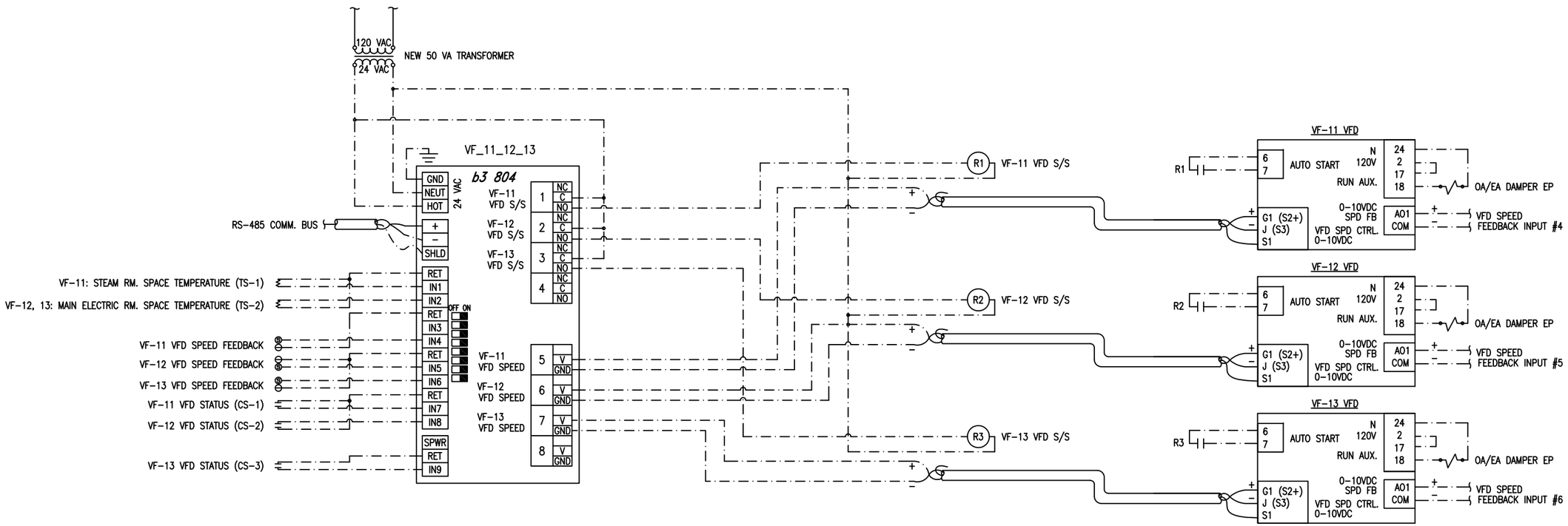
= EXISTING WIRING

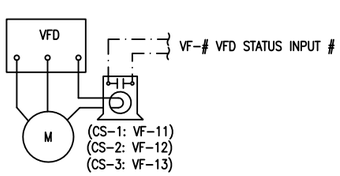
= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

# ECM-9G: EMCS CONTROL OF EXHAUST FANS AT RAVENS STADIUM

| Unit # | Service | Level |
|---|---|---|
| VF-11 | South Mech. Rm. B | Service - B |
| VF-12 | South Mech. Rm. B | Service - B |
| VF-13 | South Mech. Rm. B | Service - B |




VF-# VFD FAN STATUS WIRING- TYPICAL OF 3 VFDs (VF-11,12,13)

SEE DWG. 3.7 FOR PANEL LAYOUT AND BILL OF MATERIALS

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| TS-1,2 | 2 | Mamac | TE-205-EX-7-0 | 32°F to 158°F | Space temp. sensor |
| R-1,2,3 | 3 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |
| CS-1,2,3 | 3 | Veris | H904 | 3.5-135A | Split core current switch for VFDs |

Title

VF-11,12,13 VFD
Hardwired Points

Project/Location

M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 6.2 RAVENS VF-11,12,13 VFD |

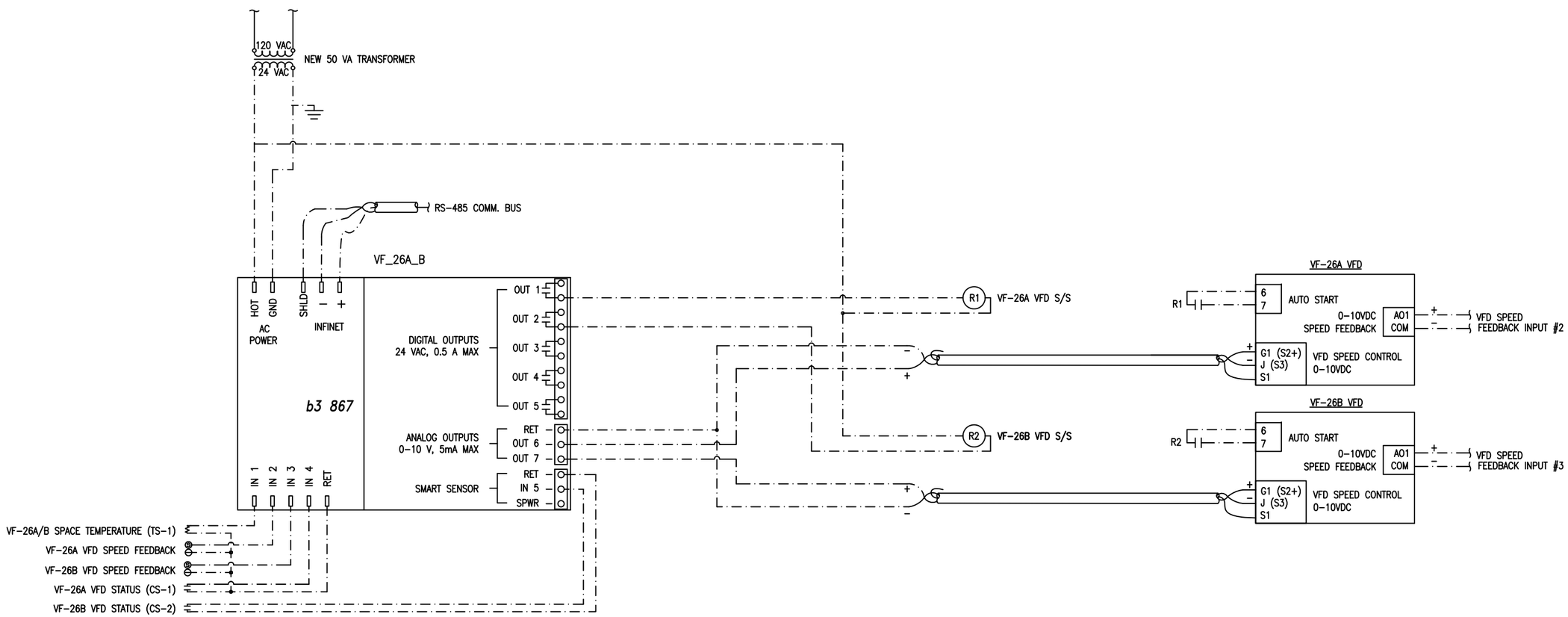
= EXISTING WIRING

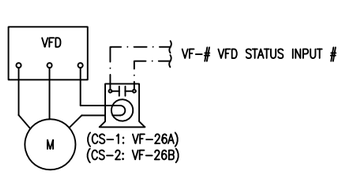
= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

# ECM-9G: EMCS CONTROL OF EXHAUST FANS AT RAVENS STADIUM

| Unit # | Service | Level |
|---|---|---|
| VF-26A & B | Electric Room | Press-A |
| VF-27A & B | Electric Room | Press-B |
| VF-28A & B | Electric Room | Press-C |
| VF-29A & B | Electric Room | Press-D |




VF-26A & B VFD FAN STATUS WIRING, TYPICAL FOR 6 ADDITIONAL VFDS ((VF-27,28,29(A&B))

SEE DWG. 3.6 FOR PANEL LAYOUT AND BILL OF MATERIALS

Typical for 4

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| TS-1 | 1 | Mamac | TE-205-EX-7-0 | 32°F to 158°F | Space temp. sensor |
| R-1,2 | 2 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |
| CS-1,2 | 2 | Veris | H904 | 3.5-135A | Split core current switch for VFDs |

Title

VF-26A_B VFD Hardwired Points. Typical for VF-27,28,29(A&B)

Project/Location

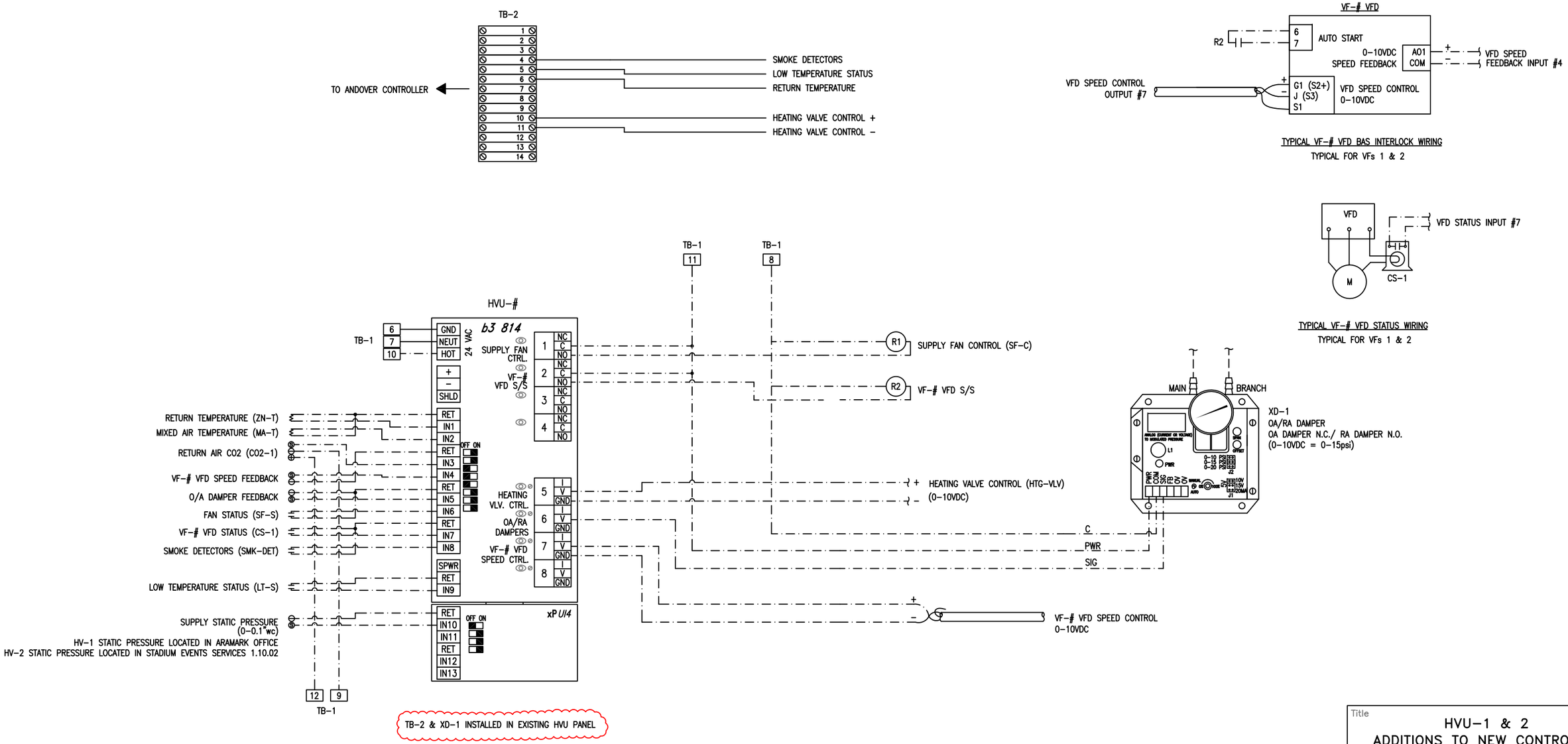
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 6.3 RAV.VF-26_27_28_29AB_VFD |

ECM-9H: MODIFY OPERATION OF SERVICE LEVEL HEATING AND VENTILATING UNITS AT RAVENS STADIUM – CONTROLLER REPLACEMENT REQUIRED

# ECM-9H: MODIFY OPERATION OF SERVICE LEVEL HEATING AND VENTILATING UNITS AT RAVENS STADIUM – CONTROLLER REPLACEMENT REQUIRED




Typical for 2 Units

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| ZN-T | 1 | MAMAC | TE-205-G-7 | -40°F to 140°F ± .4F° | Space temp. sensor without enclosure |
| MA-T | 1 | MAMAC | TE-707-B-7-B-2 | -40°F to 160°F ± .4F° | Duct averaging temperature sensor, 12', galvanized steel enclosure |
| CO2-1 | 1 | TAC/AirTest | ATT-TR9292-B | 0-2000 ppm | Duct CO2 Transmitter, 0-10V or 4-20mA output |
| CS-1 | 1 | Veris | H904 | 3.5-135A | Split core current switch for VFDs |
| R-2 | 1 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |

Title
HVU-1 & 2
ADDITIONS TO NEW CONTROLLER

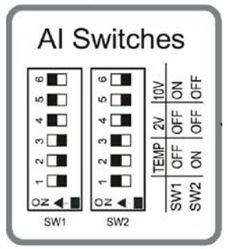
Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 7.2 RAVENS.HVU-1&2_Add._Wiring |

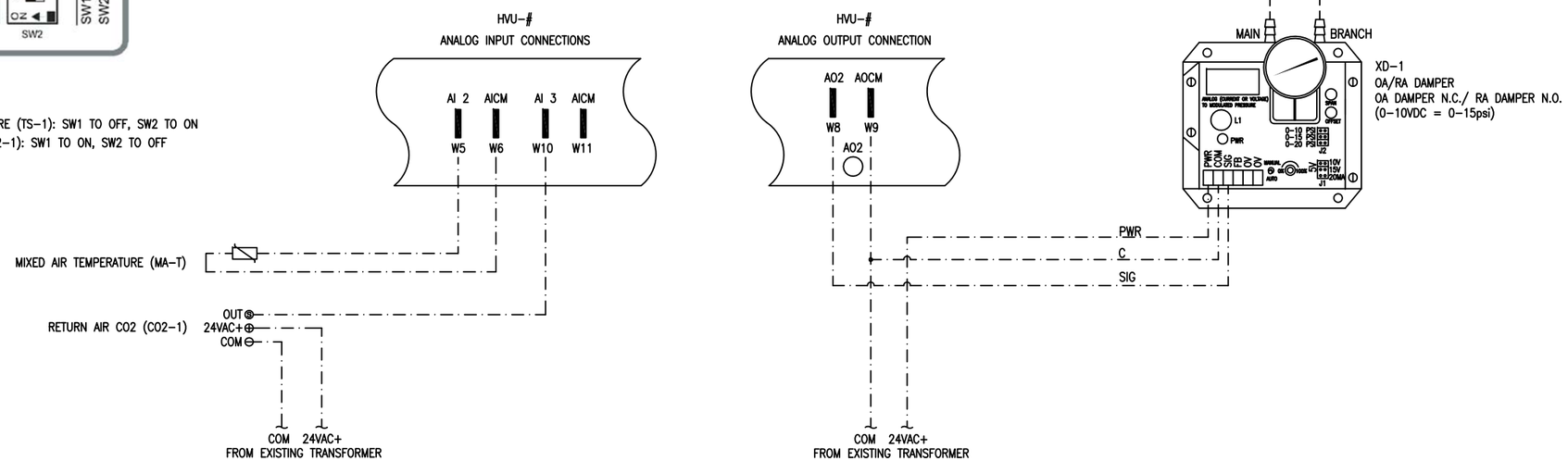
# ECM-9H: MODIFY OPERATION OF SERVICE LEVEL HEATING AND VENTILATING UNITS AT RAVENS STADIUM

Analog Input Switches




SWITCH SETTINGS:

MIXED AIR TEMPERATURE (TS-1): SW1 TO OFF, SW2 TO ON
RETURN AIR CO2 (CO2-1): SW1 TO ON, SW2 TO OFF




= EXISTING WIRING

= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

Typical for 2 Units

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| MA-T | 1 | MAMAC | TE-707-B-4-B-2 | -40°F to 160°F ± .4F° | Duct averaging temperature sensor, 12', galvanized steel enclosure |
| CO2-1 | 1 | TAC/AirTest | ATT-TR9292-B | 0-2000 ppm | Duct CO2 Transmitter, 0-10V or 4-20mA output |
| XD-1 | 1 | ACT | EPC2GFSB | 0 to 10,15,20 VDC , 0-20mA | Analog Current or Voltage Input to Pneumatic Output including Fail Safe |

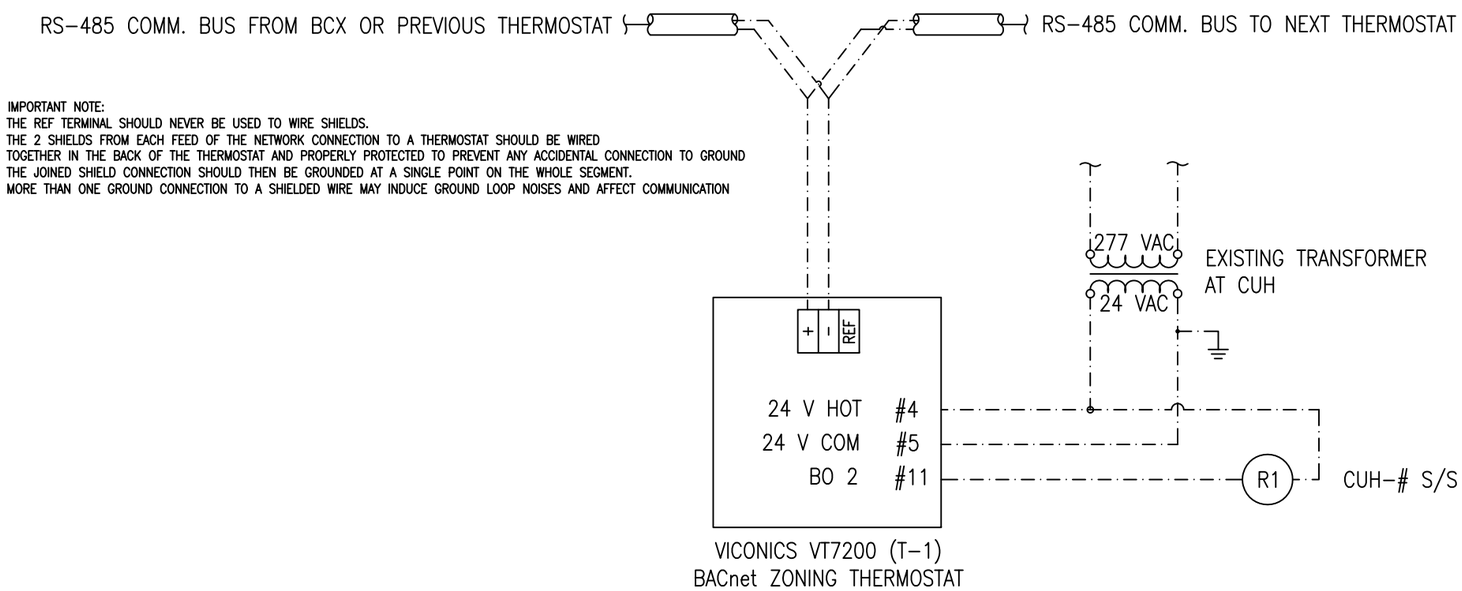
Title
HVU-3 & 5
ADDITIONS TO EXISTING JC

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

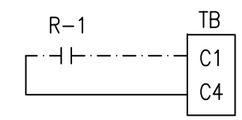

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 7.3 RAVENS.HVU-3&5_Add._Wiring |

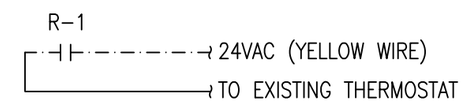
# ECM–8E: HEATING CONTROLS UPGRADE AT RAVENS STADIUM




WIRING TYPICAL FOR 141 CUHs
SEE DRAWING 2.1 THROUGH 2.4 FOR QUADS A THRU D RS–485 BACnet COMM. TOPOLOGY




START/STOP WIRING FOR NEW CUHs FOR RESTROOMS




START/STOP WIRING FOR OLD CUHs IN CONCESSION AREA AND FOOD PREP.

= EXISTING WIRING

= NEW WIRING

# = TERMINATION NUMBER AND SYMBOL

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| R-1 | 141 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |
| T-1 | 141 | Viconics | VT7200C5018B | 40°F to 90°F | 24vac Zoning Thermostat, BACnet MS-TP communicating model |

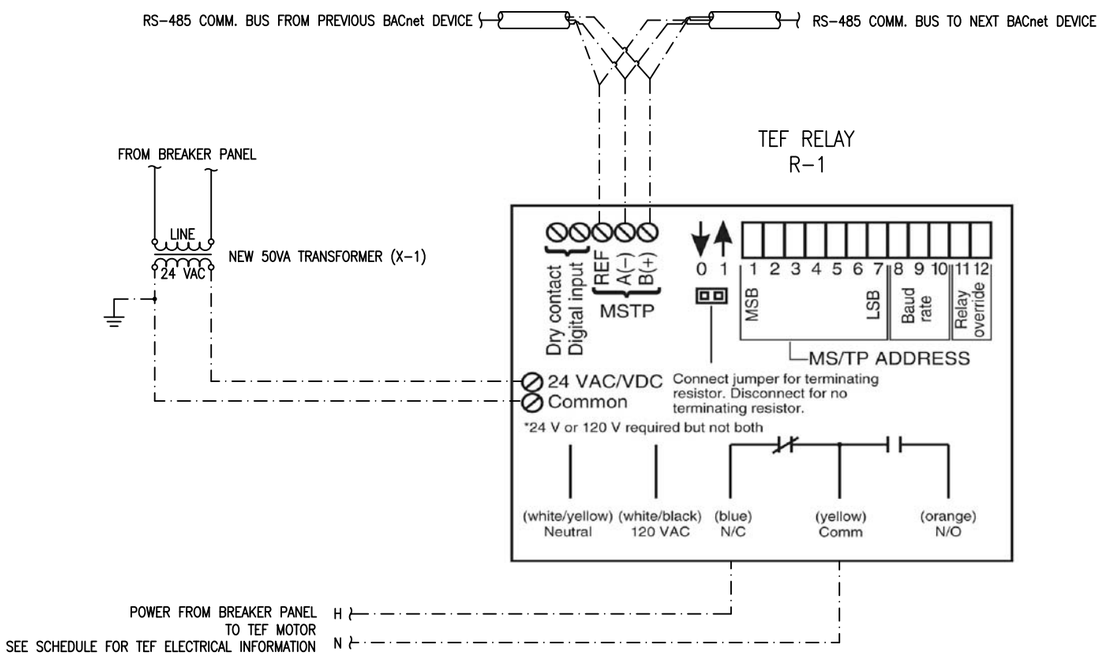
Title
CABINET UNIT HEATERS
THERMOSTAT WIRING (Typ. 141)

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

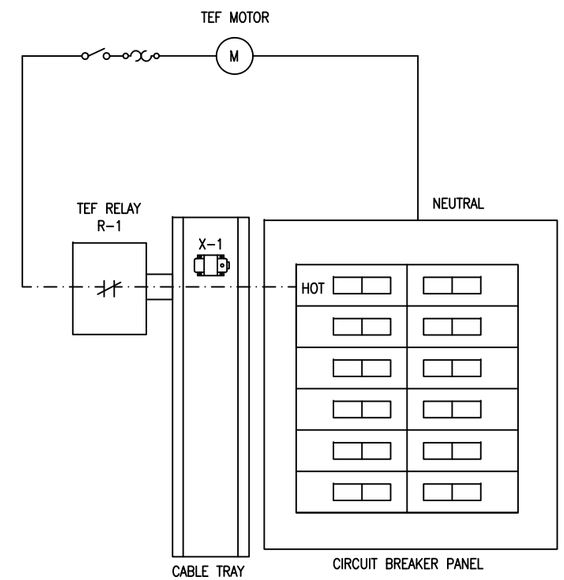

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471–6310
Fax (703) 471–3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 8.1 RAVENS_CUHs |

# ECM-9G: EMCS CONTROL OF EXHAUST FANS AT RAVENS STADIUM




## TEF RELAY WIRING DIAGRAM




## TEF REMOTE WIRING (SINGLE PHASE SHOWN)

SEE DRAWING 2.1 THROUGH 2.4 FOR QUADS A THRU D RS-485 BACnet COMM. TOPOLOGY & RELAY LOCATIONS

| DIP Switches 8 | 9 | 10 | Baud Rate |
|---|---|---|---|
| 0 | 0 | 0 | 9600 |
| 0 | 0 | 1 | 19200 |
| 0 | 1 | 0 | 38400 |
| 0 | 1 | 1 | 57600 |
| 1 | 0 | 0 | 76800 |
| 1 | 0 | 1 | 115200 |

All other combinations=9600 baud

| DIP Switches 11 | 12 | Relay State* |
|---|---|---|
| 1 | 0 | Auto |
| X | 1 | Override on |
| 0 | 0 | Override off |

*Device must be powered for override

* Dry contact digital input is a general purpose input that is not tied to the relay internally. Can be used with any dry contact switching device, such as a current sensor, to feed back to the network.

Notes:
» MS/TP Address & Baud Rate must be set prior to power up via DIP switches.
» Device ID will default to 277XXX where XXX is the MS/TP Address.
Examples:
» Device ID can be changed via network command. Once changed, it will no longer default to 277XXX.
(MS/TP Address & Device ID must be unique.)
» PIC Statement Available for Download
» Objects included in device are:
BO 1 (Binary output)
BI 1 (Binary input)
BI 2 (Binary input)
AI 1 (Analog input)
» This model utilizes only:
BO 1
BI 1
» Device Instance changed via Object Identifier Property of Device Object

| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| R-1 | 80 | Kele | RIBTW2401B-BC | 20amp @ 277vac | 24vac SPDT BACnet relay in a box |
| X-1 | 80 | Veris | X050CBA | 120/240/277/480V~24V | Control transformer, 50 VA, w/ circuit breaker |

= EXISTING WIRING

= NEW WIRING

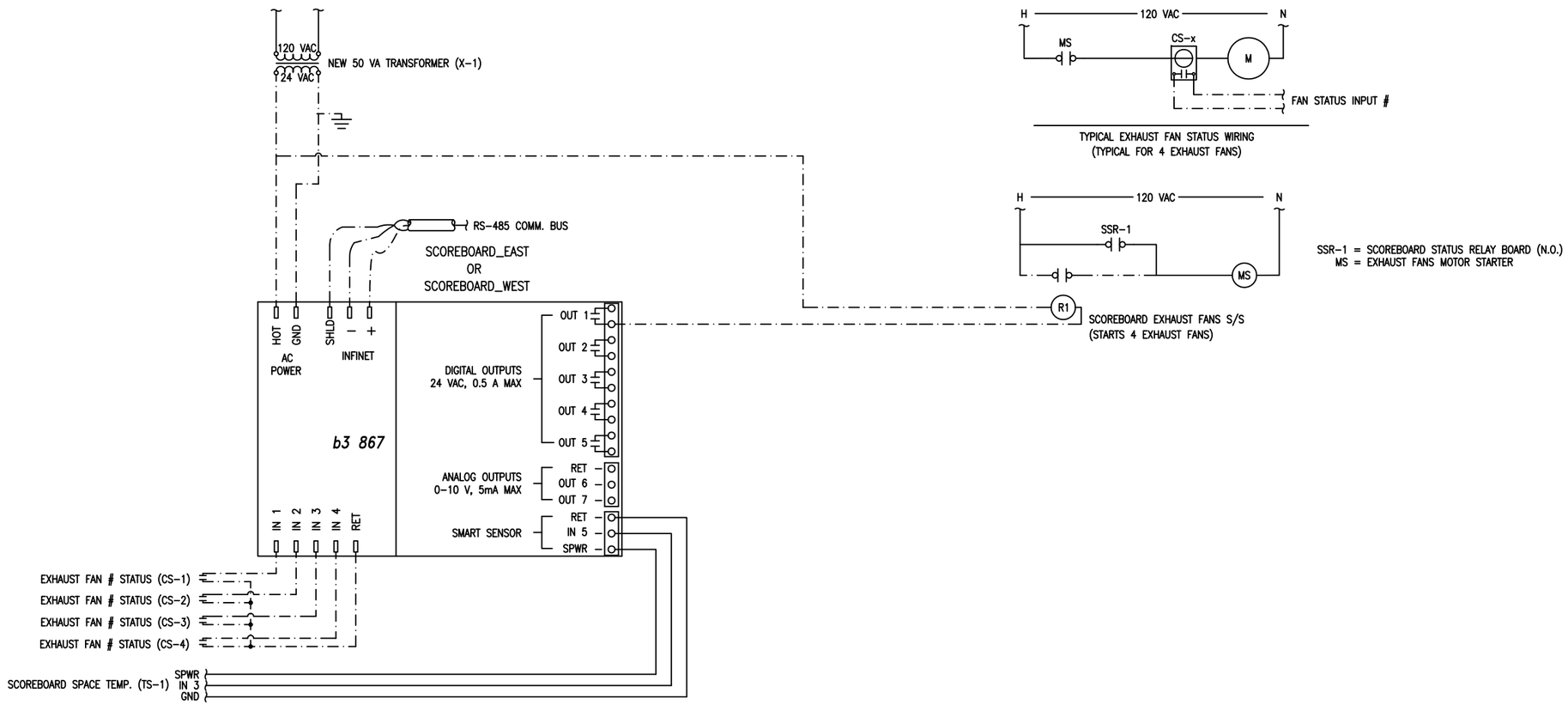
# = TERMINATION NUMBER AND SYMBOL

Title
TOILET EXHAUST FAN RELAY WIRING
(Typical for 80 TEFs)

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT


ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919


| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 8.2 RAVENS_TEF_Wiring |




| Tag | Qty. | Mfg. | Model | Range | Description |
|---|---|---|---|---|---|
| CS-1,2,3,4 | 4 | Mamac | CT-810 | 1.0-200A adj. | Solid core adjustable setpoint current switch, max 150A continuous |
| R-1 | 1 | Veris | V100 | 10amp @ 277vac | 24vac SPDT relay w/ LED. |

——— = PANEL WIRING

–·–·–·– = FIELD WIRING

[#] = TERMINATION NUMBER AND SYMBOL

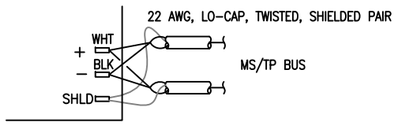
Title
SCOREBOARD EFs WIRING
(Typical for 2, EAST & WEST)

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

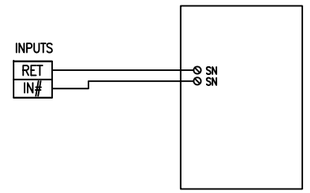
ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

PM: EK | Engineer: BH

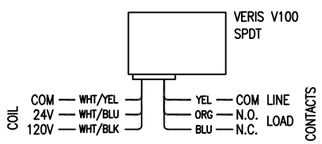
Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 8.3 Ravens Scoreboard EFs



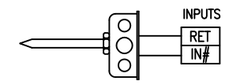

MS/TP BUS CONNECTION



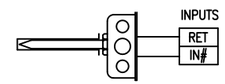

MAMAC TE-205-G-7
MAMAC TE-205-EX-7-0
SPACE SENSOR



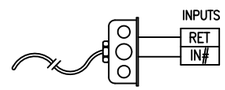

RELAY-IN-A-BOX




MAMAC TE-702-B-7-C
DUCT SENSOR

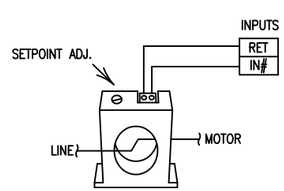



MAMAC TE-703-C-7-A-2 w/ A-500-1-B-2
IMMERSION SENSOR w/ SS THERMOWELL



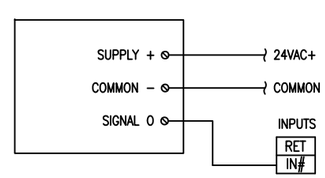

MAMAC TE-707-B-4-B-2
MAMAC TE-707-B-7-B-2
AVERAGING SENSOR

TEMPERATURE THERMISTORS




MAMAC CT-810, VERIS H904

CURRENT SENSOR (DIGITAL) INPUT




TAC/AIRTEST ATT-TR9292-B

DUCT CO2 SENSOR (VDC OUTPUT – 0-10VDC)

Title
TYPICAL WIRING DETAILS

Project/Location
M&T BANK STADIUM (RAVENS)
MARYLAND STADIUM AUTHORITY PROJECT

ESI engineered services inc
45150 Business Court
Suite 100
Sterling, Virginia 20166
Tel. (703) 471-6310
Fax (703) 471-3919

| PM: EK | | Engineer: BH |
|---|---|---|
| Asbuilt 11/22/10 | Job # 4828 | Dwg. Name 9.1 Typical_Details |