

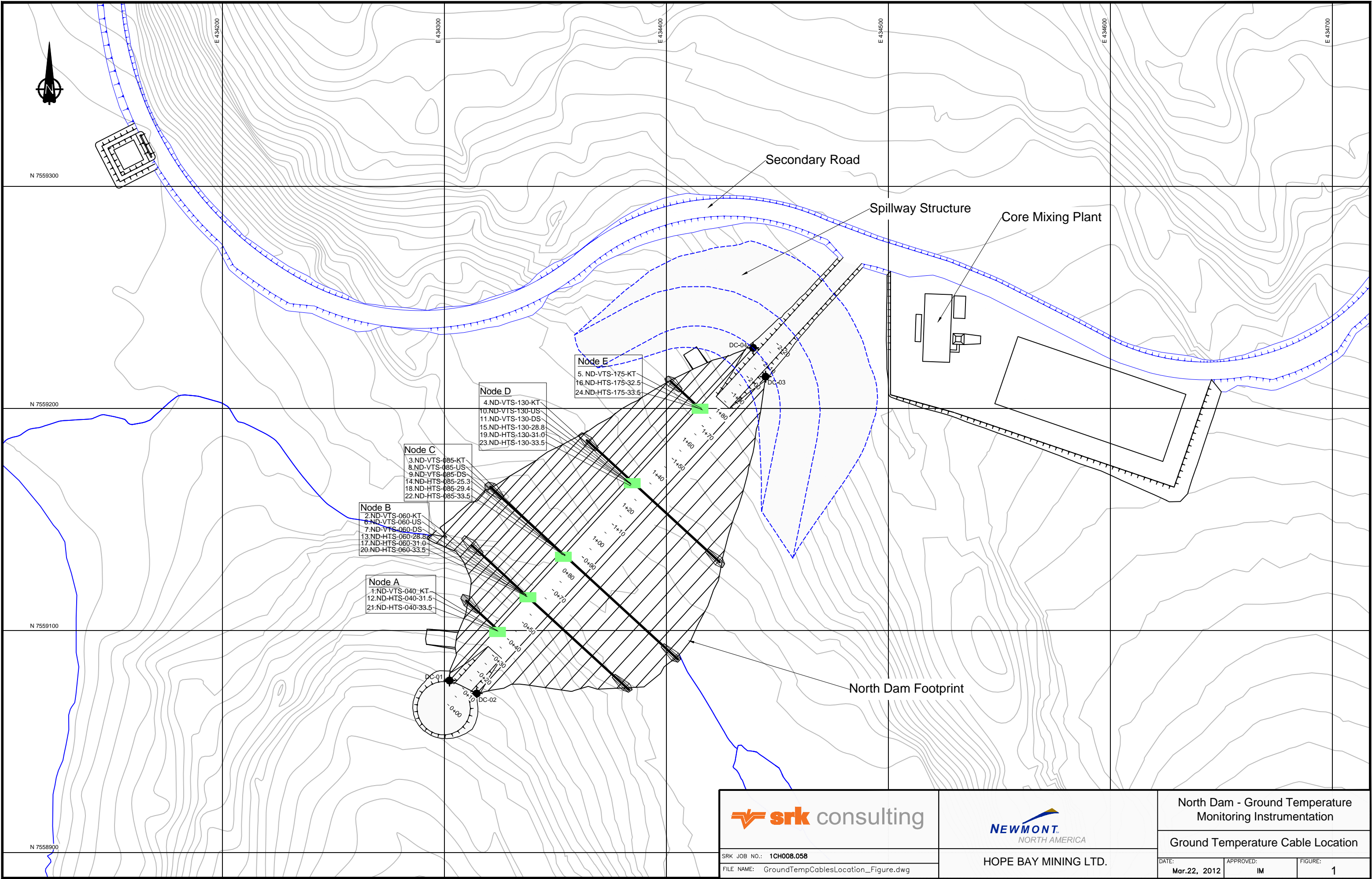
## **Appendix L:      Instrumentation**

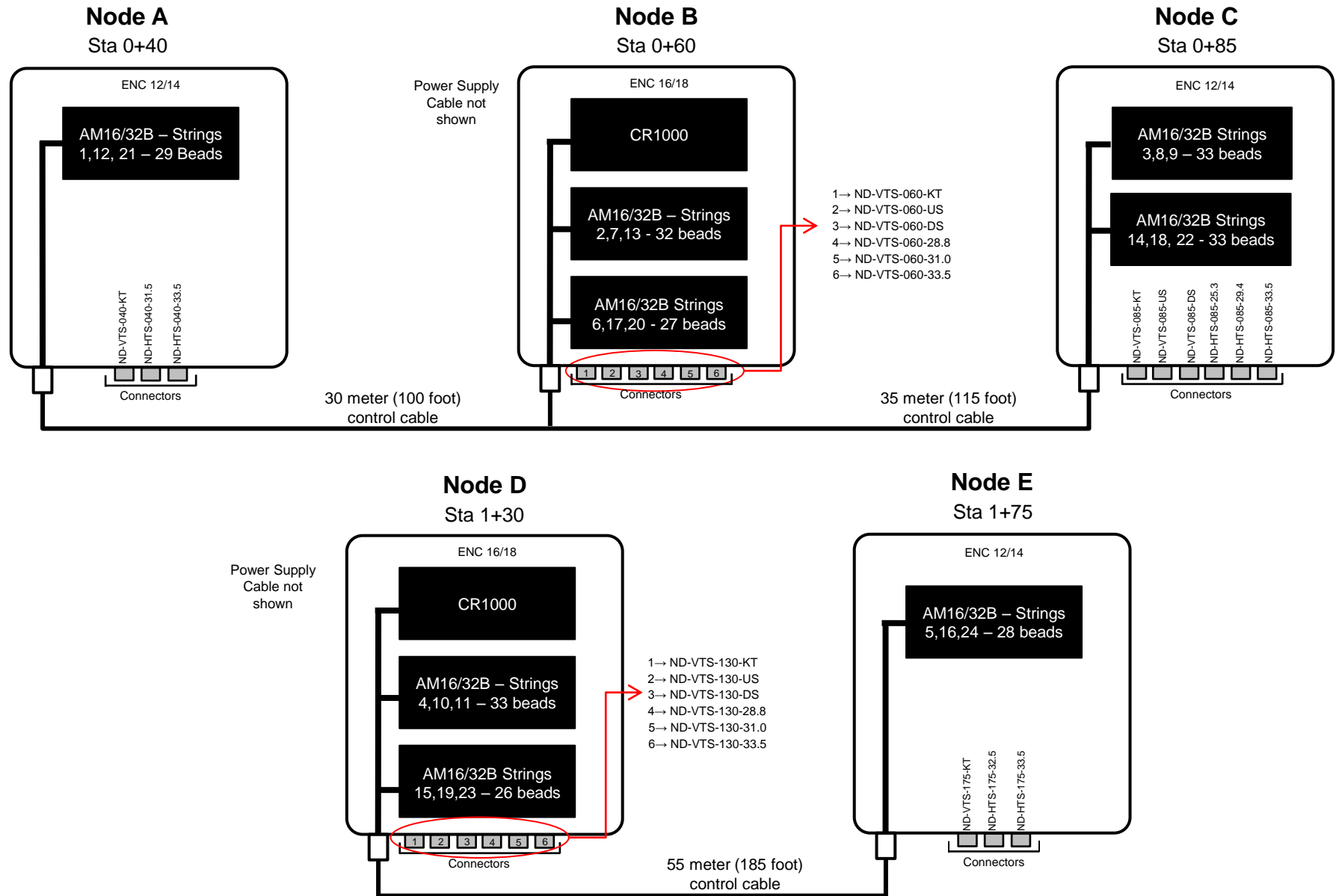
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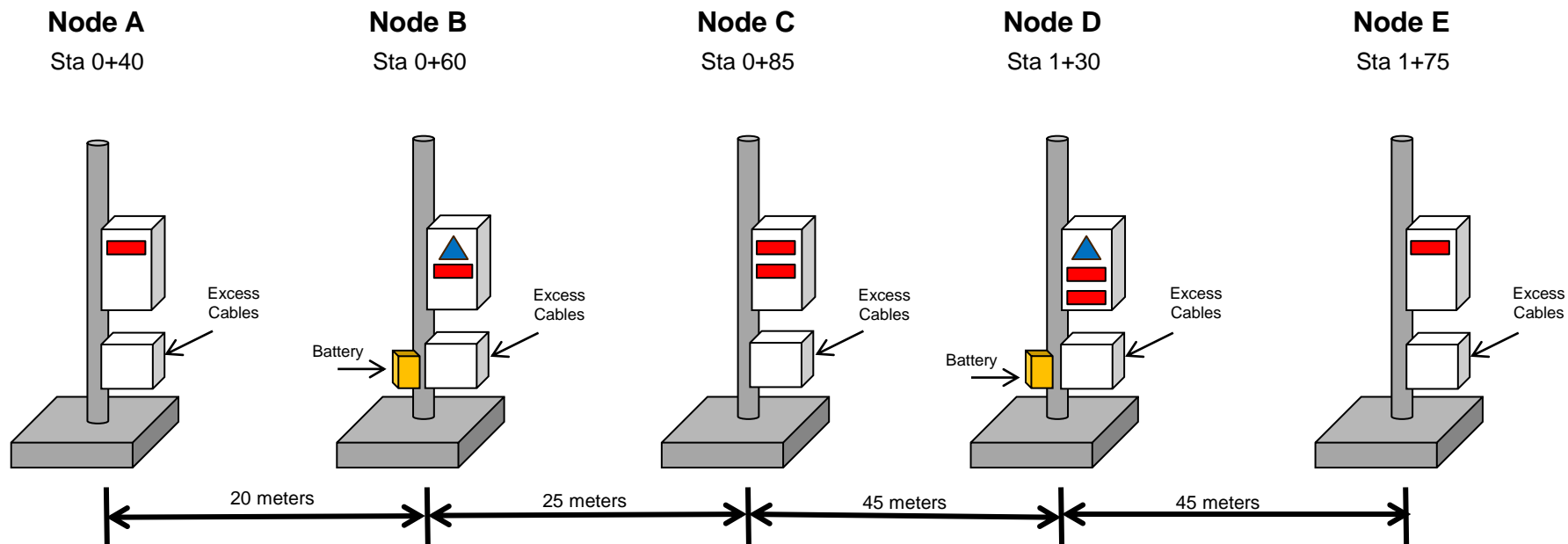
## **Appendix L.1: Instrumentation Layout**

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J:\01\_SITES\Hope Bay\1CH008.058\_Phase 1 and 2 Infrastructure Design\_Support\North Dam\Ground Temperature Cables\Instrumentation\Figures\draft\GroundTempCablesLocation\_Figure.dwg







### Legend

- AM 16/32 Multiplexer
- ▲ CR1000 Datalogger



Job No: 1CH008.058.200  
 Filename: Figs 2-3\_Nodes\_1CH008.058\_20120323.ppt



**HOPE BAY MINING LTD.**

North Dam – Ground Temperature  
 Monitoring Instrumentation

Conceptual Layout of Data  
 Acquisition System

Date:  
 March 2012

Approved:  
 IM

Figure: **3**

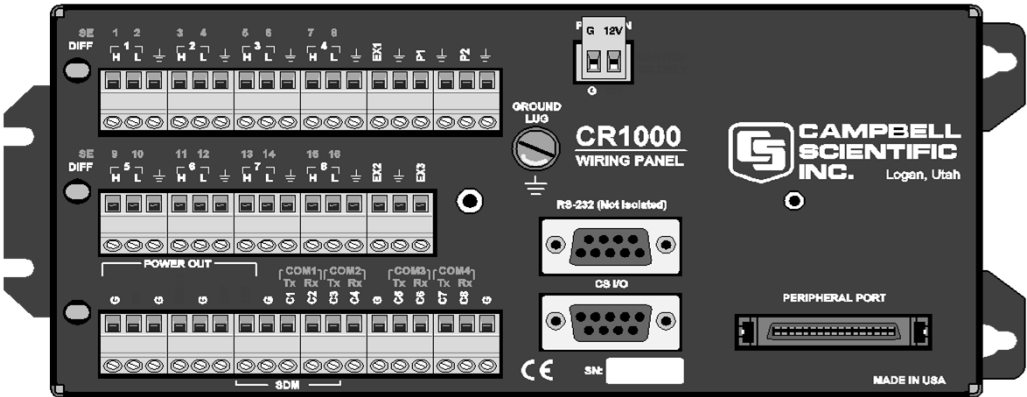
## **Appendix L.2: Wiring Diagrams**

---

CR1000 Wiring Diagram

Company:	Nuna Contracting / SRK Consulting
Project:	Hope Bay Dam project
Documented By:	Mike Ryder - Campbell Scientific Canada Corp.

CR1000 #1 Located in Node B



Ground	Black
12V	Red
Reset	White
Clock	Green
COM H (ODD)	White
COM L (ODD)	Green
COM H (EVEN)	Red
COM L (EVEN)	Black

		G
		5V
		G
		SW-12
AM16/32B #1,#2,#3 - G		G
AM16/32B #1,#2,#3 - 12V		12V
AM16/32B #4, #5, - 12V		12V
AM16/32B #4, #5 - G		G
AM16/32B#1, #5 Res		C1 (COM1 Tx)
AM16/32B#1, #5 Clk		C2 (COM1 Rx)
AM16/32B#2 Res		C3 (COM2 Tx)
AM16/32B#2 Clk		C4 (COM2 Rx)
		G
AM16/32B#3 Res		C5 (COM3 Tx)
AM16/32B#3 Clk		C6 (COM3 Rx)
AM16/32B#4 Res		C7 (COM4 Tx)
AM16/32B#4 Clk		C8 (COM4 Rx)
		G

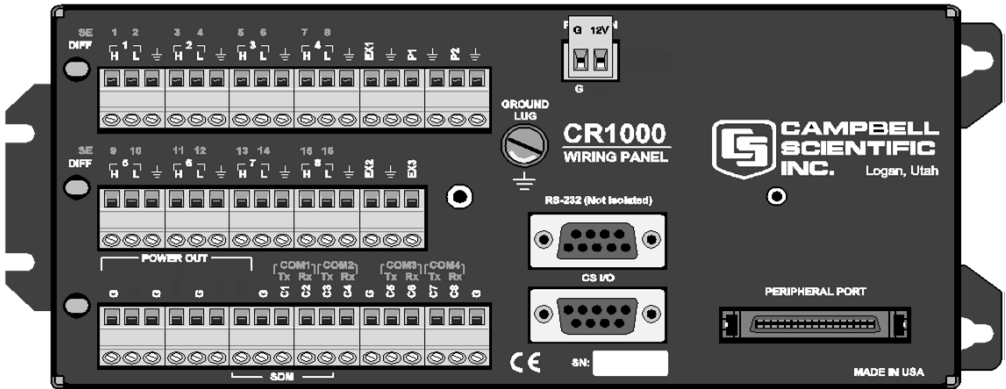
Battery 12V (Red)	G 12V	12V
Battery G (Black)	G	G
AM16/32B#3 COM L(EVEN) - RES to		5H (SE9)
AM16/32B#4 COM L(ODD) - RES to		5L (SE10)
RES to SE10, SE11, SE12		
AM16/32B#4 COM H(EVEN) - RES to		6H (SE11)
AM16/32B#4 COM L(EVEN) - RES to		6L (SE12)
AM16/32B#5 COM L(ODD) - RES to		7H (SE13)
AM16/32B#5 COM H(EVEN) - RES to		7L (SE14)
RES to SE13, SE14, SE15		
AM16/32B#5 COM L(EVEN) - RES to		8H (SE15)
		8L (SE16)
AM16/32B #3,#4 COM H(ODD)		EX2
AM16/32B #5 COM H(ODD)		EX3

AM16/32B#1 COM L(ODD) - RES to		1H (SE1)
AM16/32B#1 COM H(EVEN) - RES to		1L (SE2)
RES to SE1, SE2, SE3		
AM16/32B#1 COM L(EVEN) - RES to		2H (SE3)
AM16/32B#2 COM L(ODD) - RES to		2L (SE4)
RES to SE4, SE5, SE6		
AM16/32B#2 COM H(EVEN) - RES to		3H (SE5)
AM16/32B#2 COM L(EVEN) - RES to		3L (SE6)
RES to SE7, SE8, SE9		
AM16/32B#3 COM L(ODD) - RES to		4H (SE7)
AM16/32B#3 COM H(EVEN) - RES to		4L (SE8)
AM16/32B#1,#2 COM H(ODD)		EX1
		P1
		P2

CR1000 Wiring Diagram

Company:	Nuna Contracting / SRK Consulting
Project:	Hope Bay Dam project
Documented By:	Mike Ryder - Campbell Scientific Canada Corp.

CR1000 #2 Located in Node D



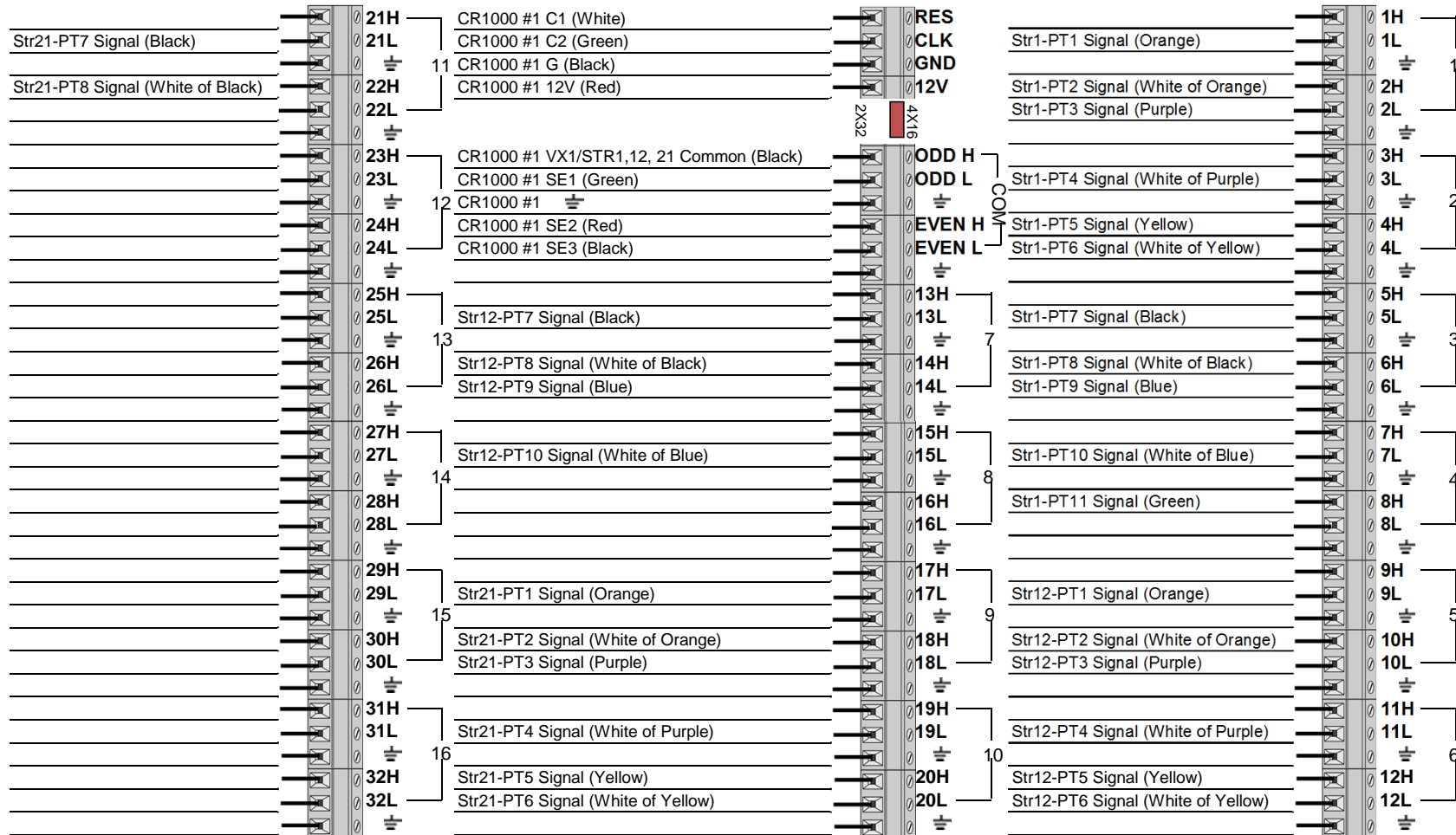
Ground	Black
12V	Red
Reset	White
Clock	Green
COM H (ODD)	White
COM L (ODD)	Green
COM H (EVEN)	Red
COM L (EVEN)	Black

	G
	5V
	G
	SW-12
	G
AM16/32B #8, #9 - G	G
AM16/32B #8, #9 - 12V	12V
AM16/32B #6, #7 - 12V	12V
AM16/32B #6, #7 - G	G
AM16/32B #6 Res	C1 (COM1 Tx)
AM16/32B #6 Clk	C2 (COM1 Rx)
AM16/32B #7 Res	C3 (COM2 Tx)
AM16/32B #7 Clk	C4 (COM2 Rx)
	G
AM16/32B #8 Res	C5 (COM3 Tx)
AM16/32B #8 Clk	C6 (COM3 Rx)
AM16/32B #9 Res	C7 (COM4 Tx)
AM16/32B #9 Clk	C8 (COM4 Rx)
	G

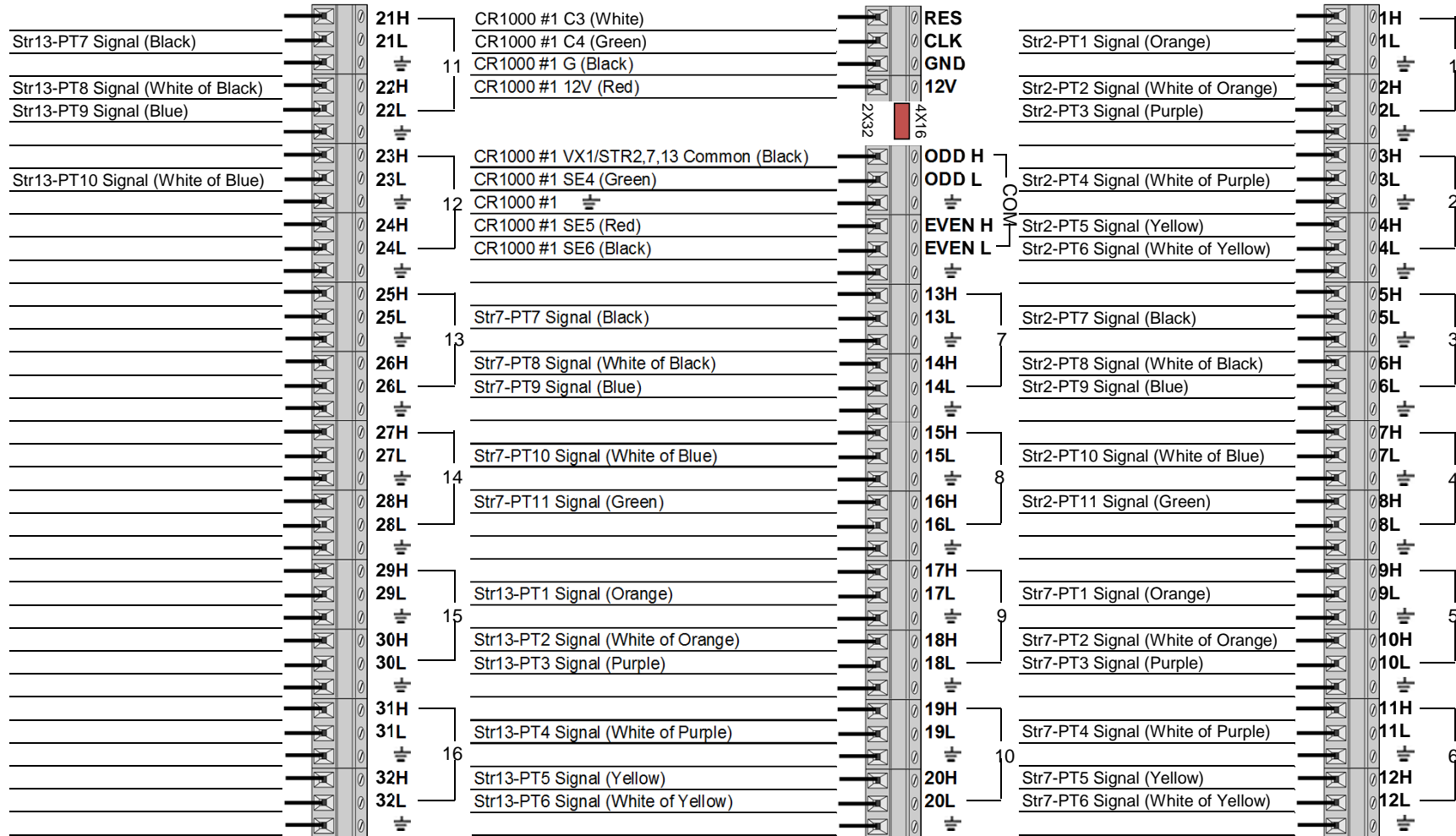
Battery 12V (Red)	12V
Battery G (Black)	G
AM16/32B#8 COM L(EVEN) - RES to	5H (SE9)
AM16/32B#9 COM L(ODD) - RES24.9 to	5L (SE10)
RES to SE10	
	6H (SE11)
	6L (SE12)
	7H (SE13)
	7L (SE14)
	8H (SE15)
	8L (SE16)
AM16/32B #8 COM H(ODD)	EX2
AM16/32B #9 COM H (ODD)	EX3

AM16/32B#6 COM L(ODD) - RES to	1H (SE1)
AM16/32B#6 COM H(EVEN) - RES to	1L (SE2)
RES to SE1, SE2, SE3	
AM16/32B#6 COM L(EVEN) - RES to	2H (SE3)
AM16/32B#7 COM L(ODD) - RES to	2L (SE4)
RES to SE4, SE5, SE6	
AM16/32B#7 COM H(EVEN) - RES to	3H (SE5)
AM16/32B#7 COM L(EVEN) - RES to	3L (SE6)
RES to SE7, SE8, SE9	
AM16/32B#8 COM L(ODD) - RES to	4H (SE7)
AM16/32B#8 COM H(EVEN) - RES to	4L (SE8)
AM16/32B #6, #7 COM H(ODD)	EX1
	P1
	P2

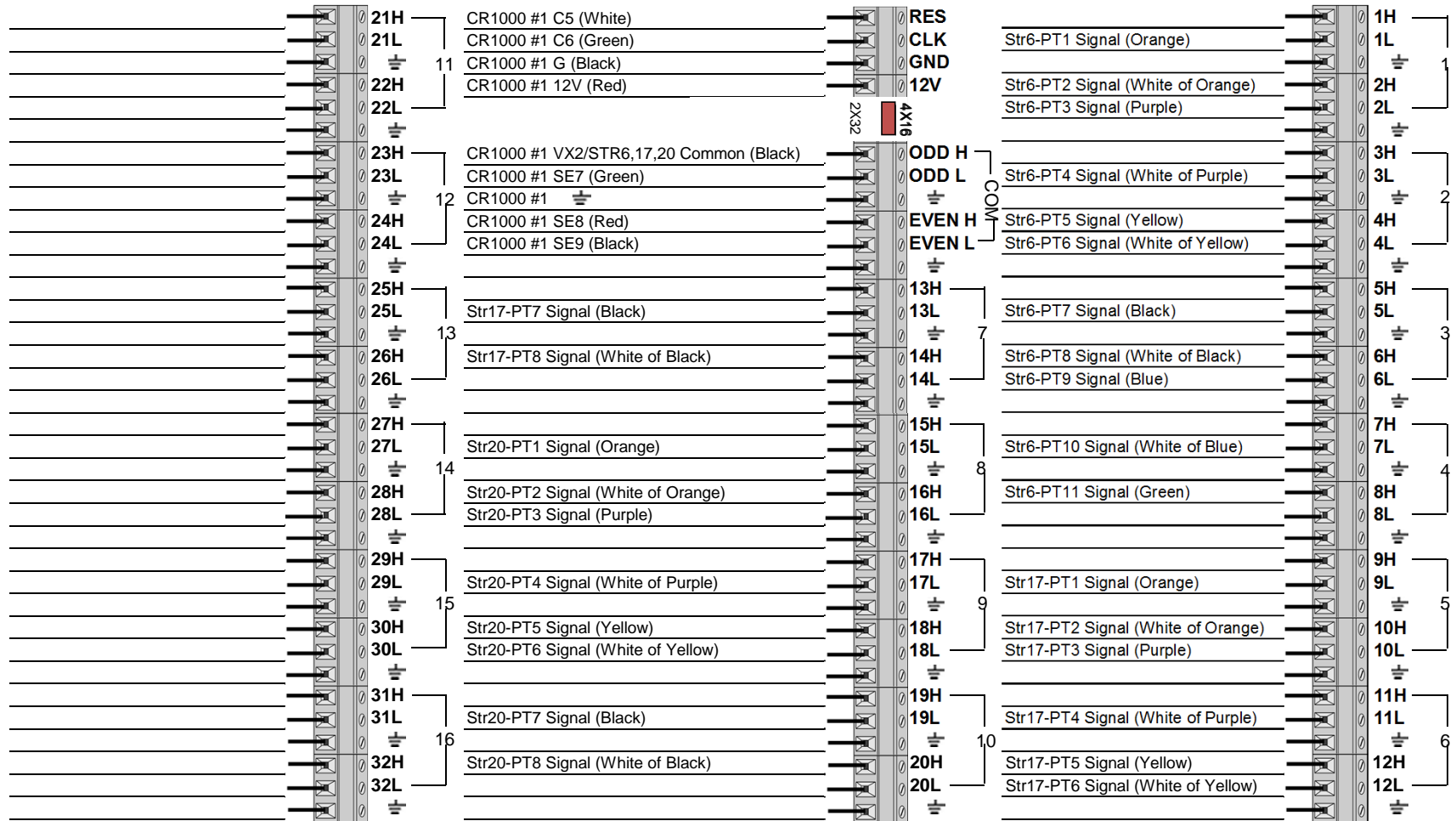
<b>AM16/32 WIRING DIAGRAM</b>		NODE A - Multiplexer #1
COMPANY:	Nuna Contracting / SRK Consulting	
PROJECT:	Hope Bay Dam project	
documented by:	Mike Ryder - Campbell Scientific Canada Corp.	



<b>AM16/32 WIRING DIAGRAM</b>		<b>NODE B - Multiplexer #2</b>	
COMPANY:	Nuna Contracting / SRK Consulting		
PROJECT:	Hope Bay Dam project		
documented by:	Mike Ryder - Campbell Scientific Canada Corp.		

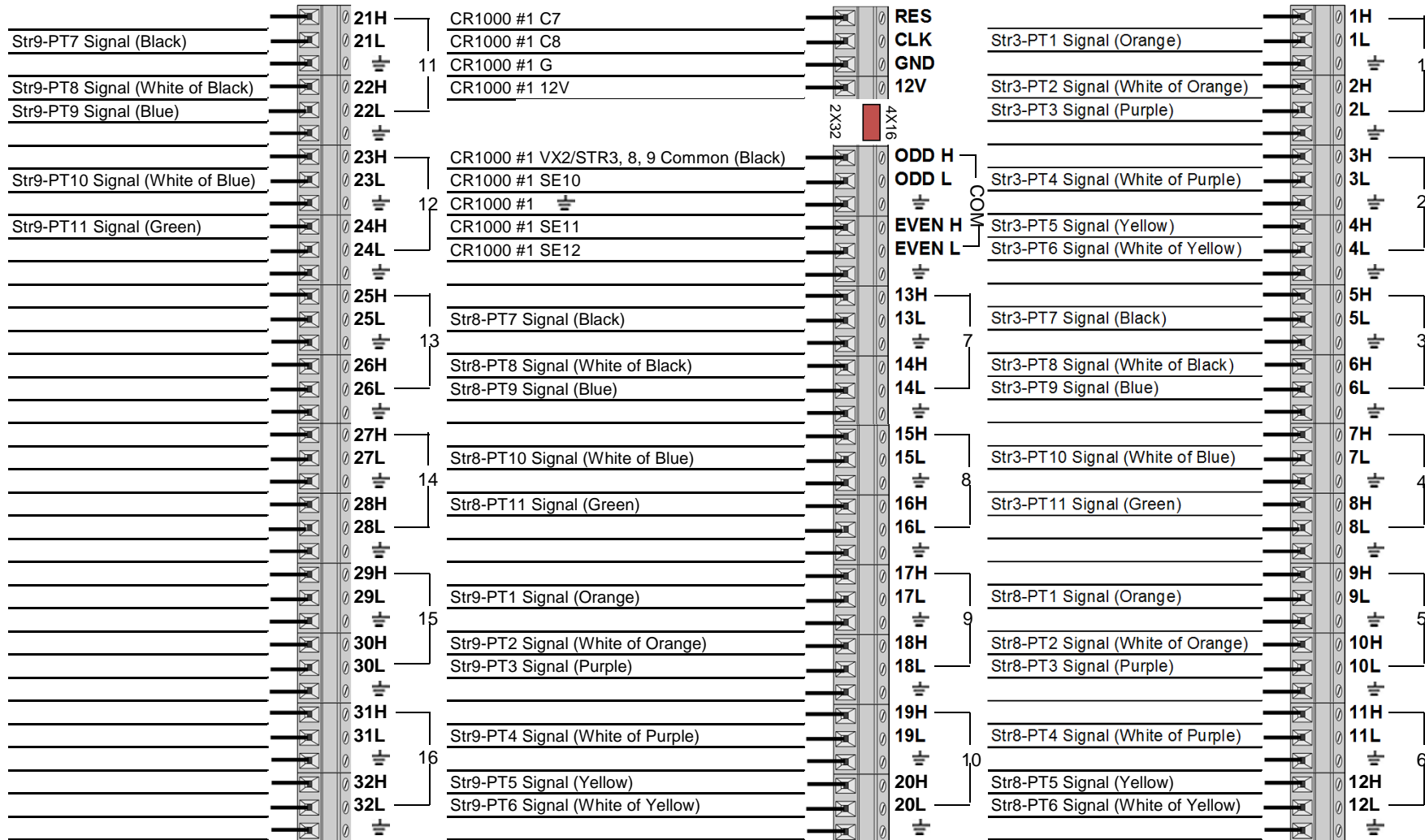


<b>AM16/32 WIRING DIAGRAM</b>	<b>NODE B - Multiplexer #3</b>
COMPANY:	Nuna Contracting / SRK Consulting
PROJECT:	Hope Bay Dam project
documented by:	Mike Ryder - Campbell Scientific Canada Corp.

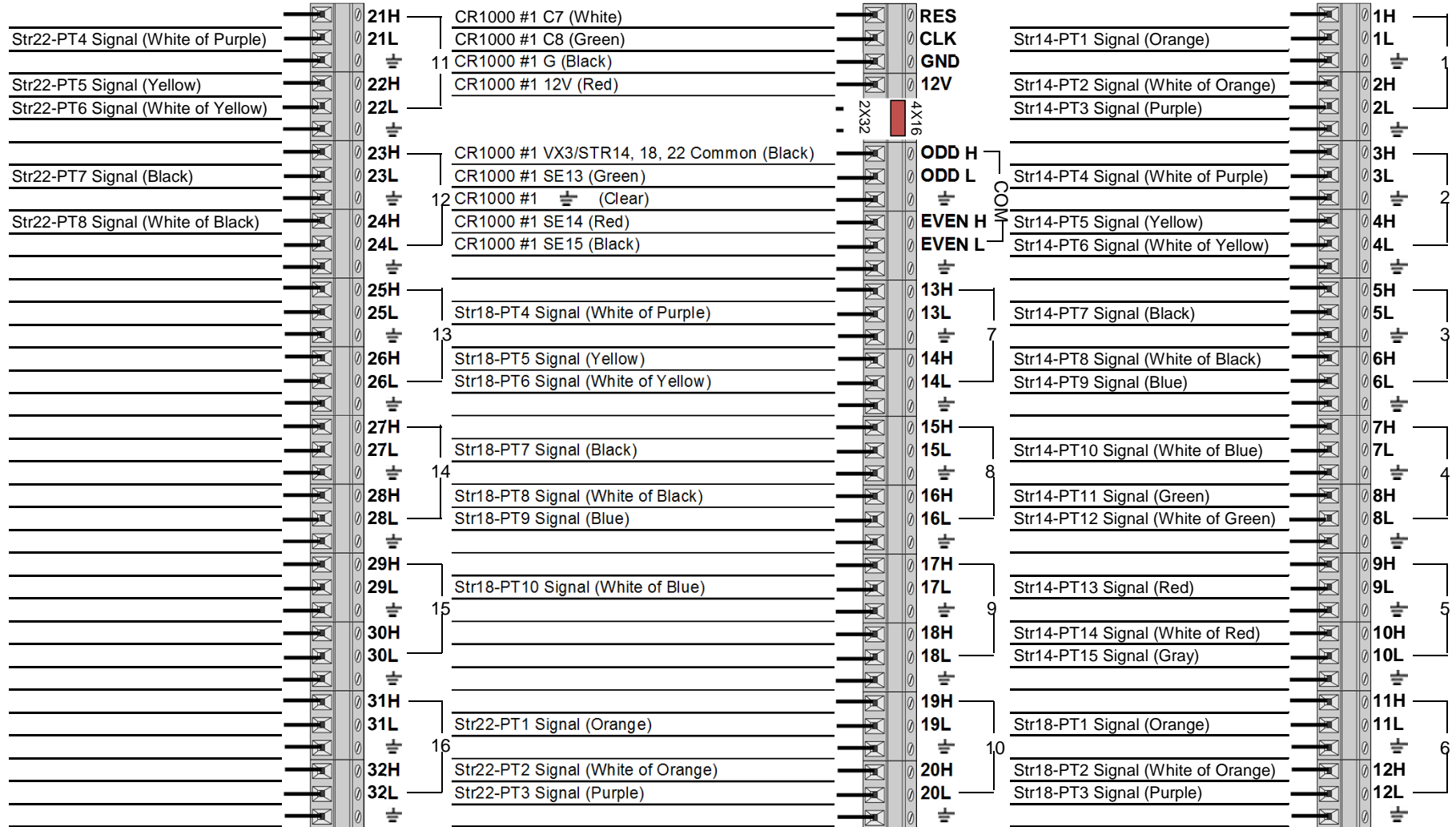


**AM16/32 WIRING DIAGRAM**    NODE C - Multiplexer #4

COMPANY:                    Nuna Contracting / SRK Consulting  
PROJECT:                    Hope Bay Dam project  
documented by:            Mike Ryder - Campbell Scientific Canada Corp.



<b>AM16/32 WIRING DIAGRAM</b>		NODE C - Multiplexer #5
COMPANY:	Nuna Contracting / SRK Consulting	
PROJECT:	Hope Bay Dam project	
documented by:	Mike Ryder - Campbell Scientific Canada Corp.	



**AM16/32 WIRING DIAGRAM**

NODE D - Multiplexer #6

COMPANY:

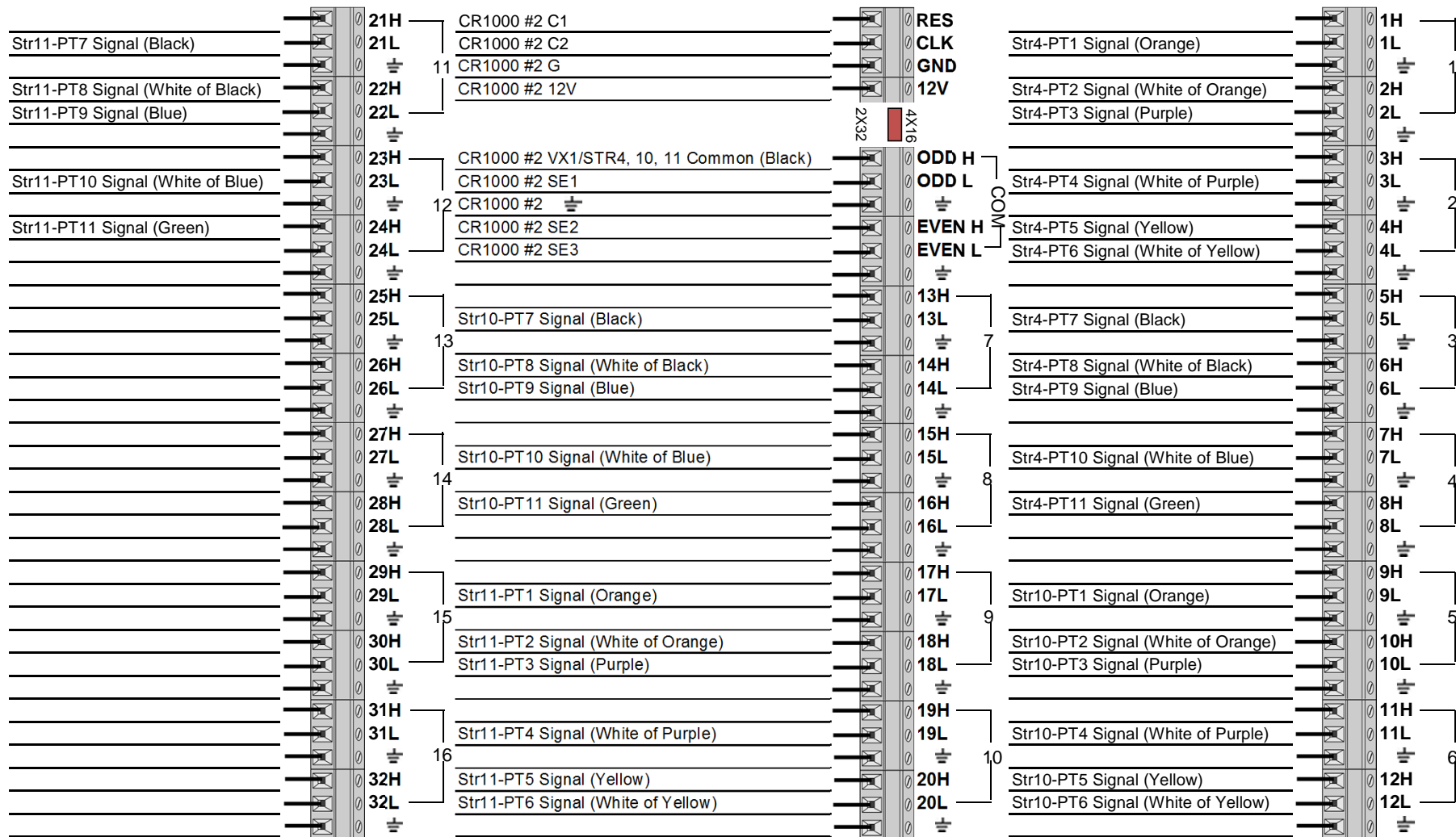
Nuna Contracting / SRK Consulting

PROJECT:

Hope Bay Dam project

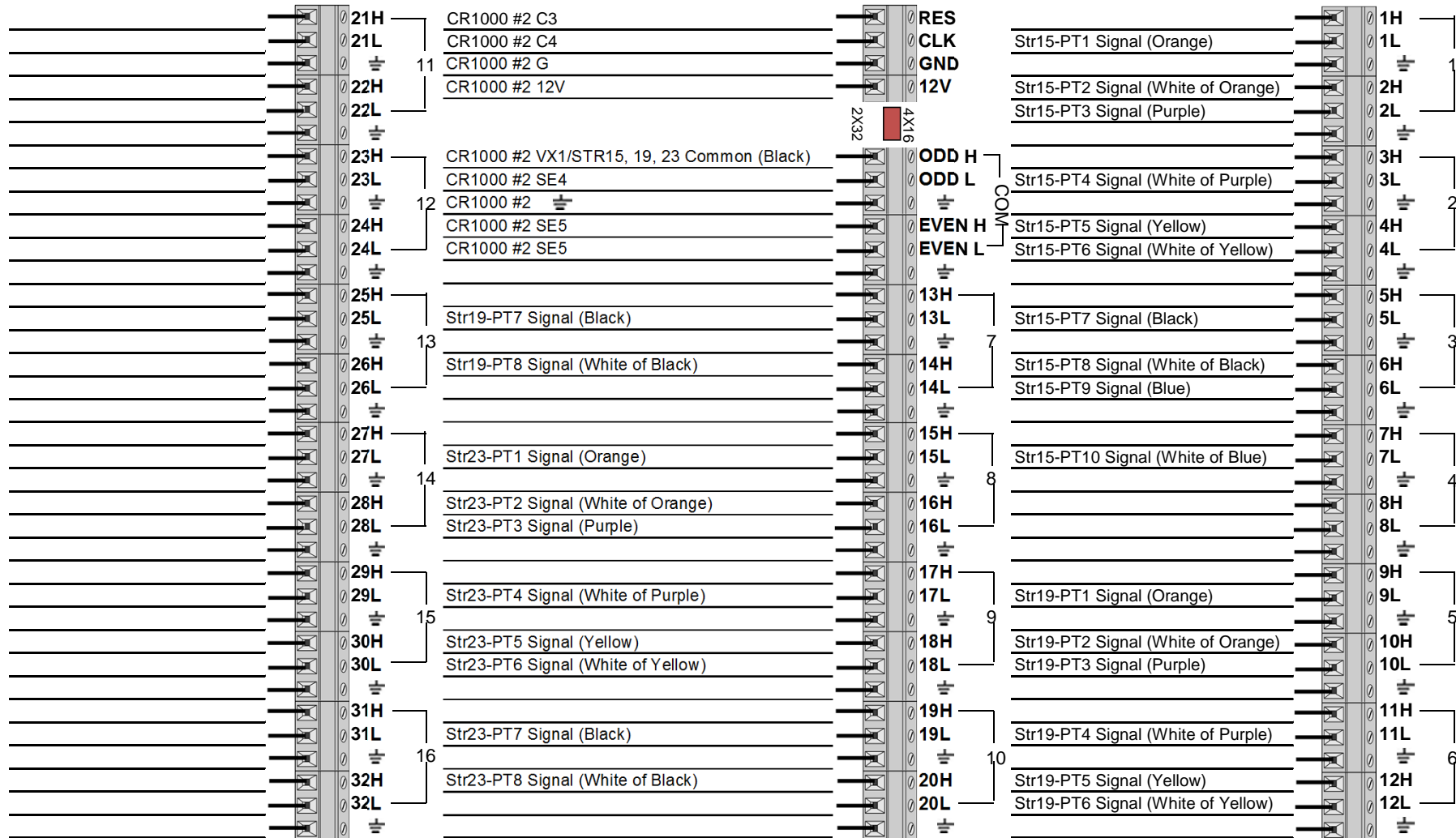
documented by:

Mike Ryder - Campbell Scientific Canada Corp.



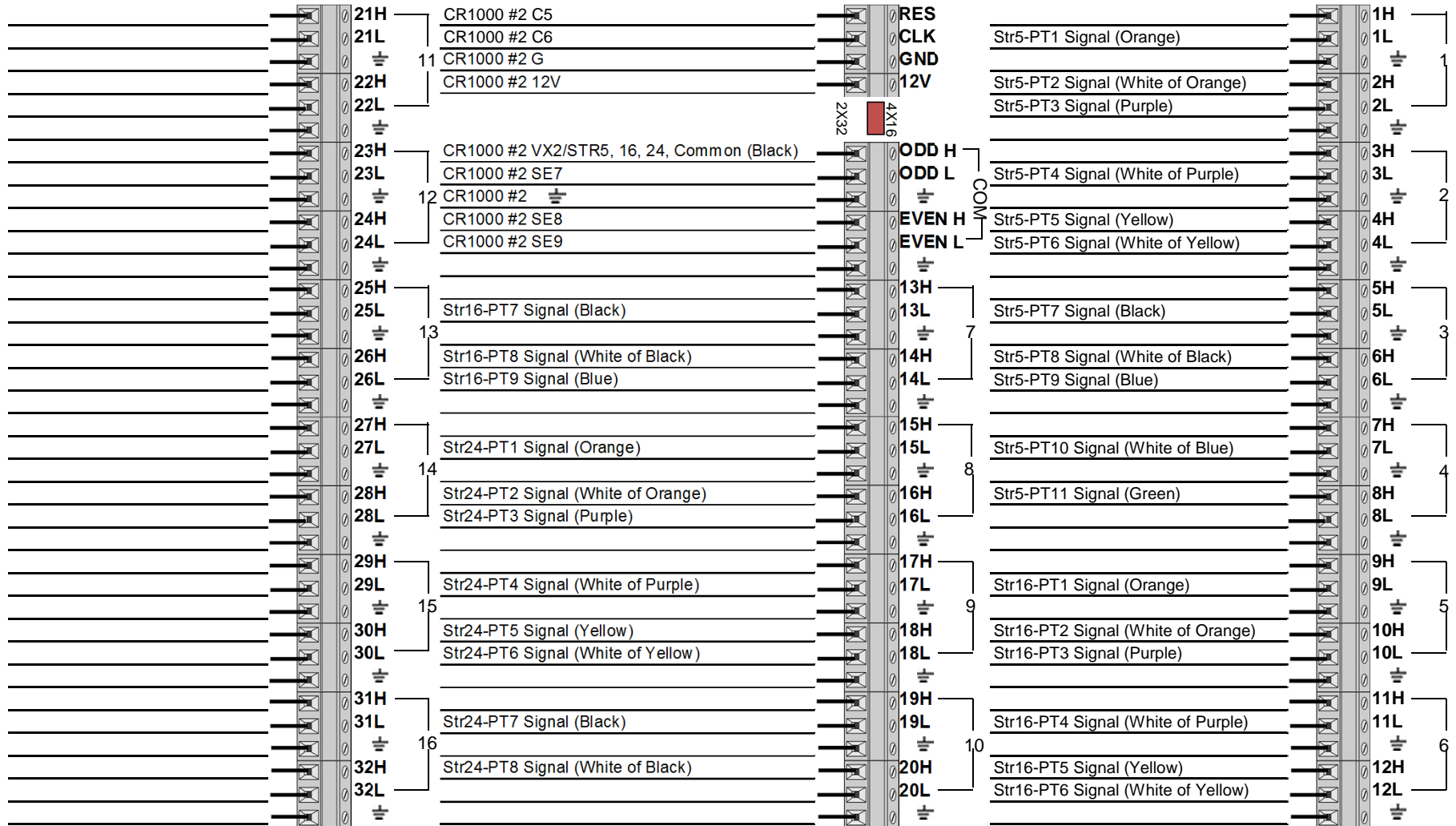
**AM16/32 WIRING DIAGRAM** NODE D - Multiplexer #7

COMPANY: Nuna Contracting / SRK Consulting  
PROJECT: Hope Bay Dam project  
documented by: Mike Ryder - Campbell Scientific Canada Corp.



# **AM16/32 WIRING DIAGRAM**    NODE E - Multiplexer #8

COMPANY: Nuna Contracting / SRK Consulting  
 PROJECT: Hope Bay Dam project  
 documented by: Mike Ryder - Campbell Scientific Canada Corp.



**AM16/32 WIRING DIAGRAM**

NODE E - Multiplexer # 9

COMPANY:

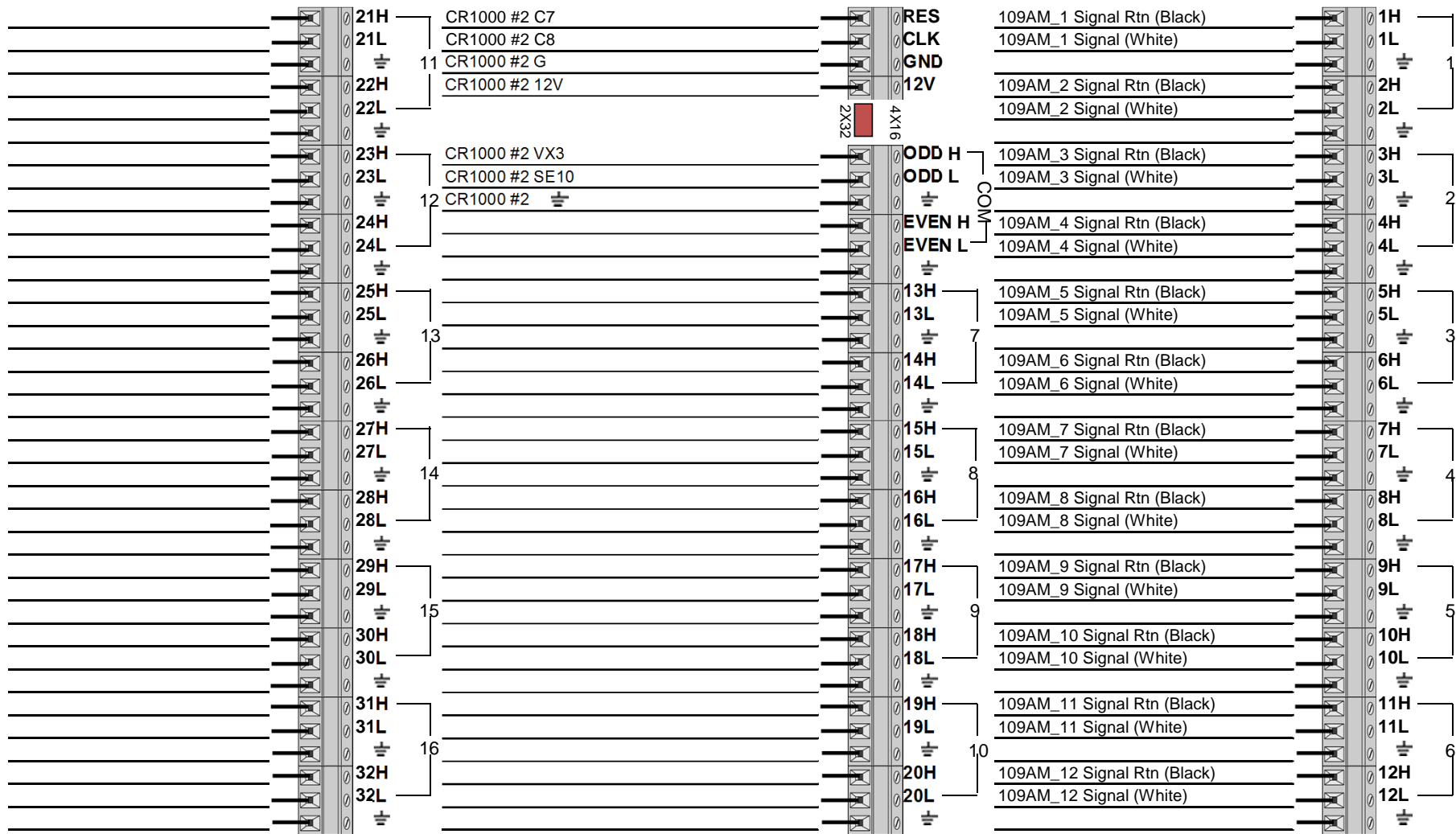
Nuna Contracting / SRK Consulting

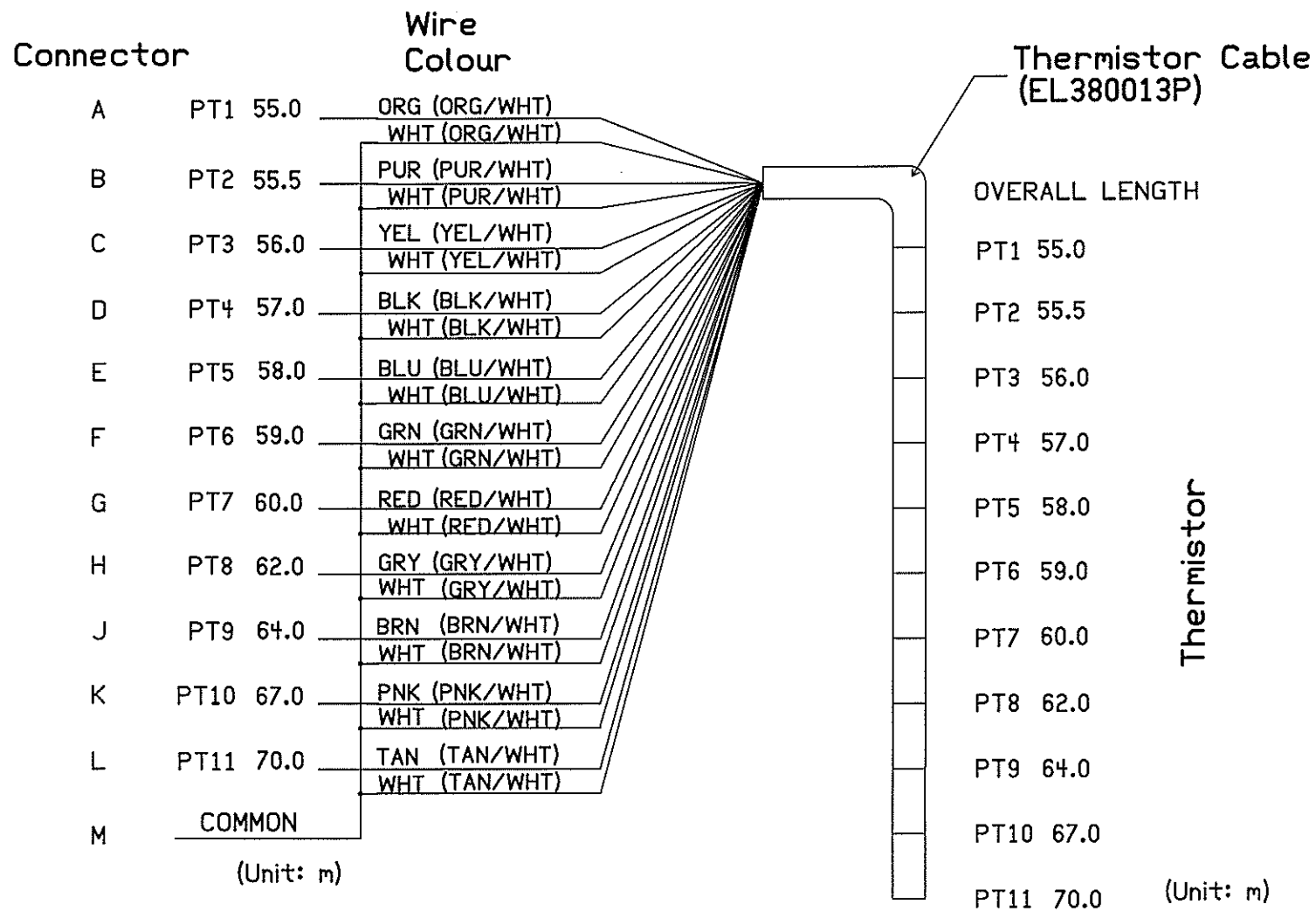
PROJECT:

Hope Bay Dam project

documented by:

Mike Ryder - Campbell Scientific Canada Corp.



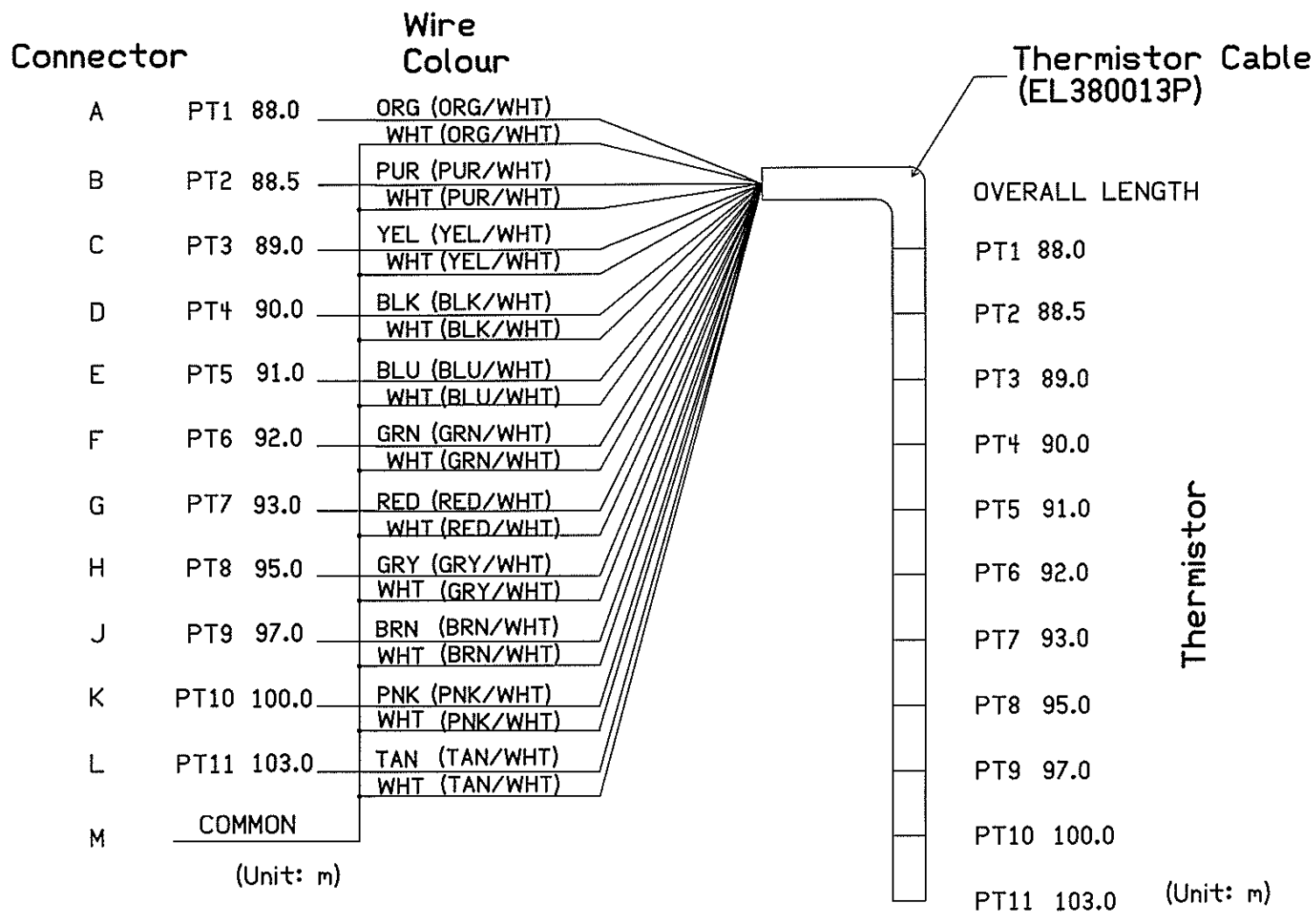


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ID: ND-VTS-040-KT



Co:	RST INSTRUMENTS LTD		
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J/N:	WOQ018560-1	Revision:	A
Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1

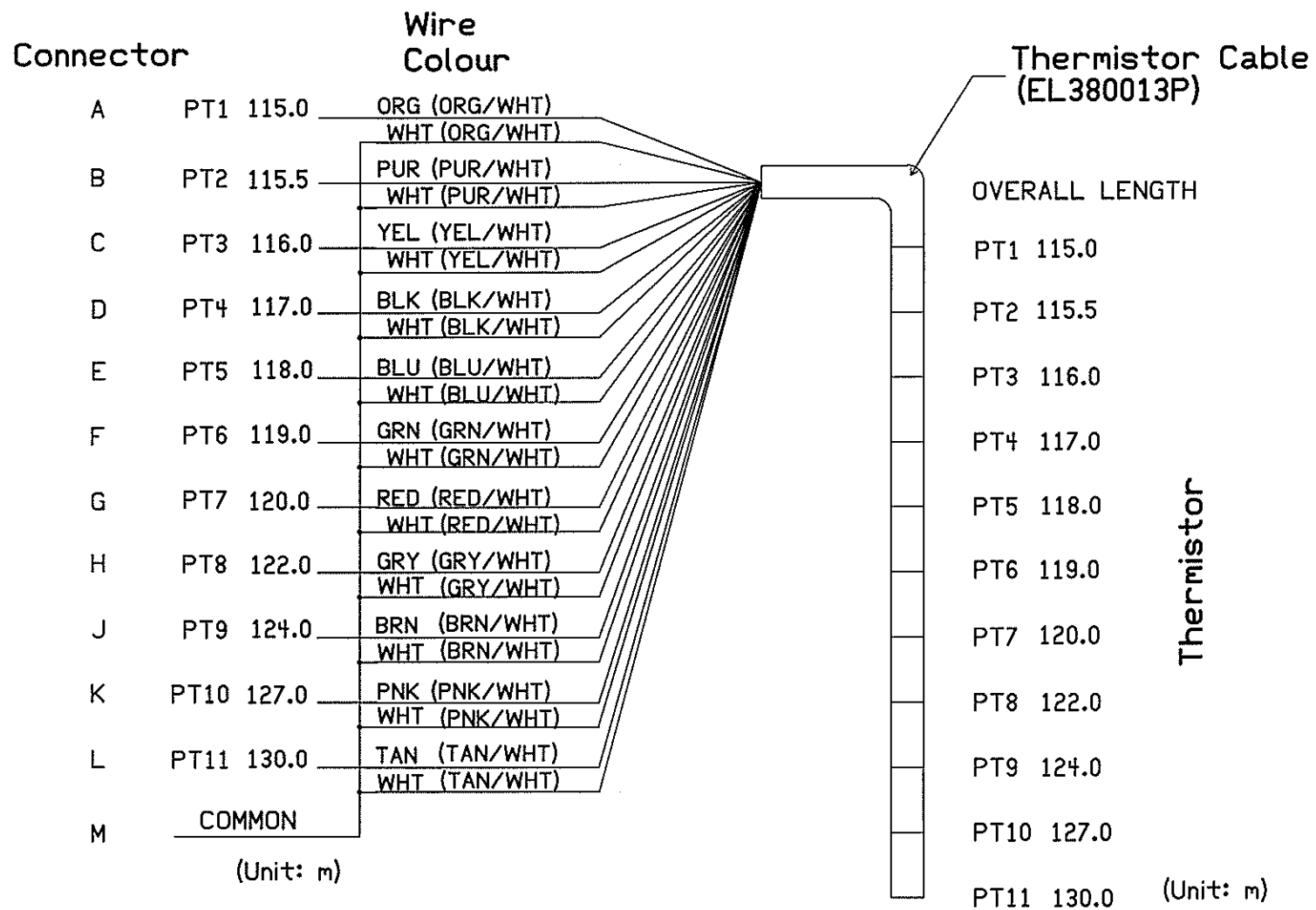


S/N: TS3081

ID: ND-VTS-060-KT



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Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1

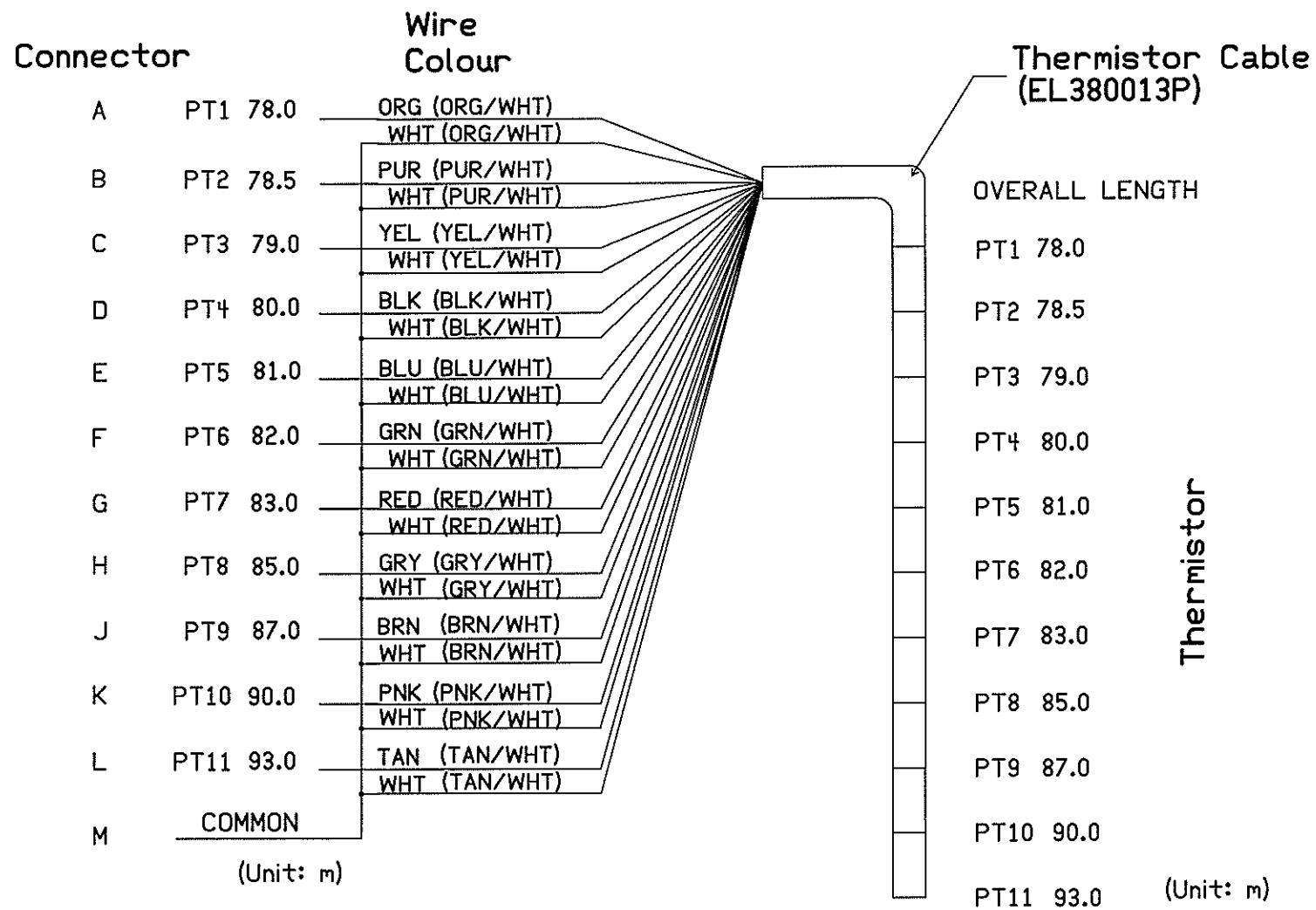


S/N: TS3082

ID: ND-VTS-085-KT



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J/N:	WOQ018560-3	Revision:	A
Author:	CB	Size:	A
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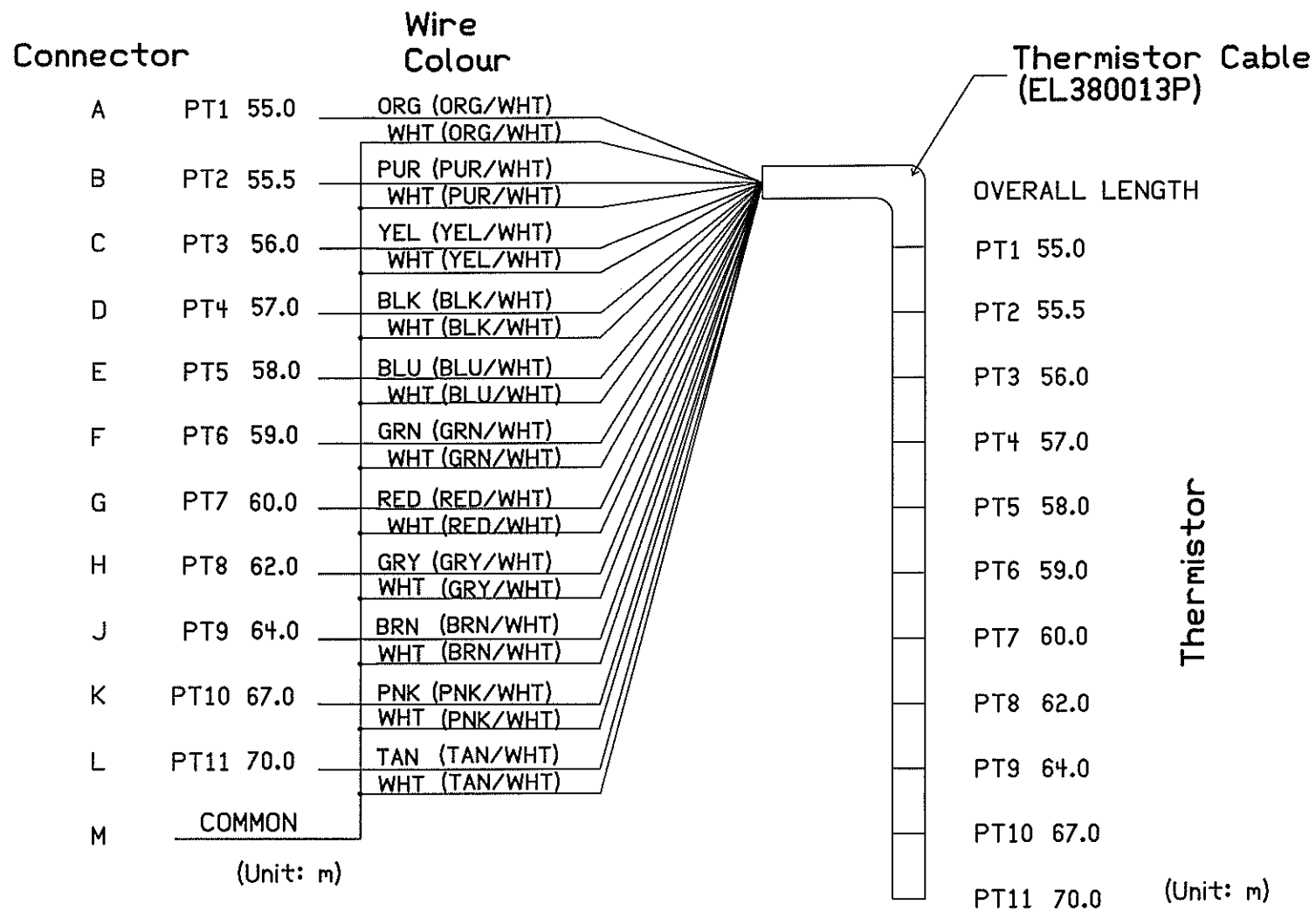


S/N: TS3083

ID: ND-VTS-130-KT



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Date:	2010/10/12	Sheet	1 of 1

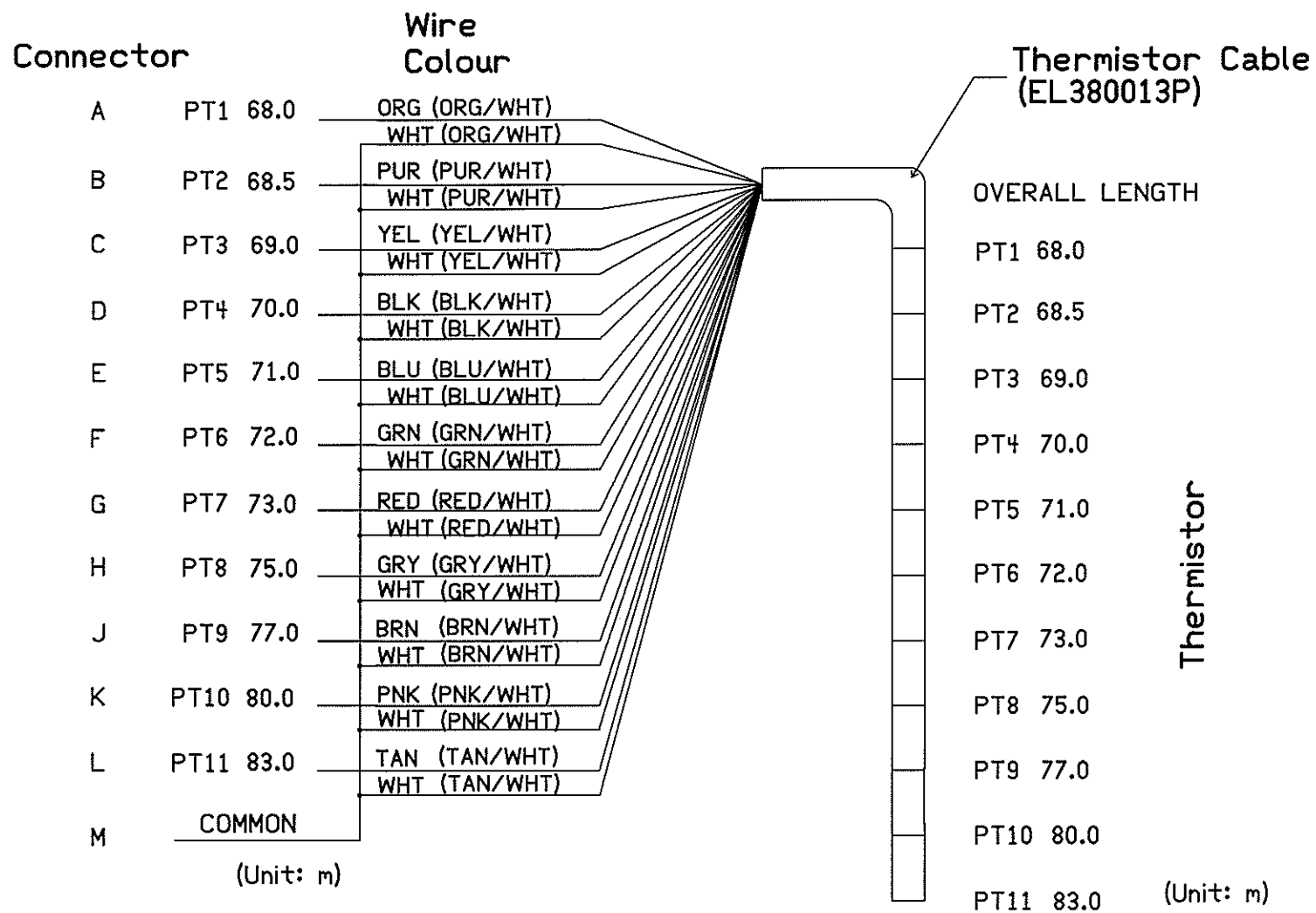


S/N: TS3084

ID: ND-VTS-175-KT



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J/N:	WOQ018560-5	Revision:	A
Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1

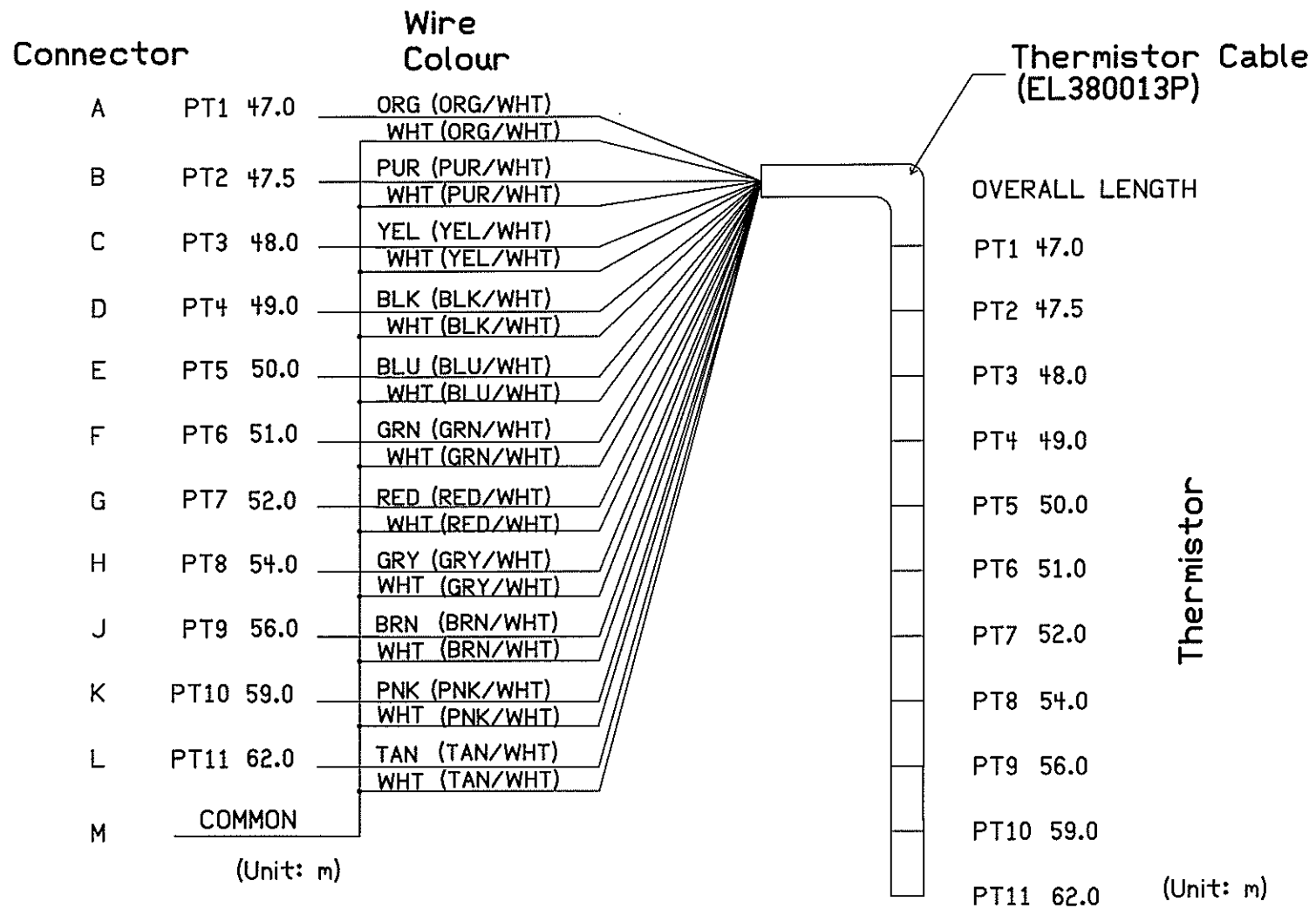


S/N: TS3085

ID: ND-VTS-060-US



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Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1

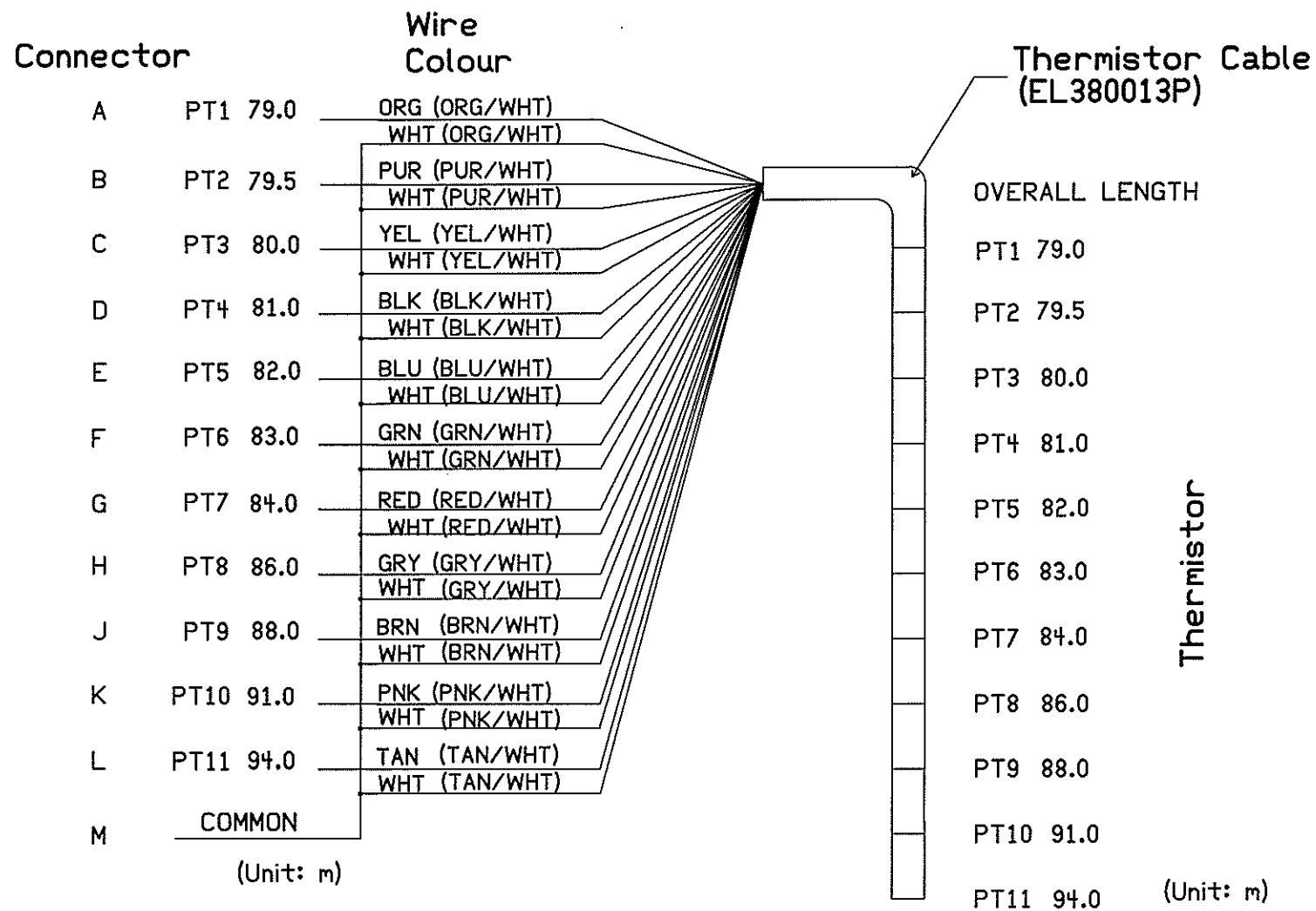


S/N: TS3086

ID: ND-VTS-060-DS



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J/N:	WOQ018560-7	Revision:	A
Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1

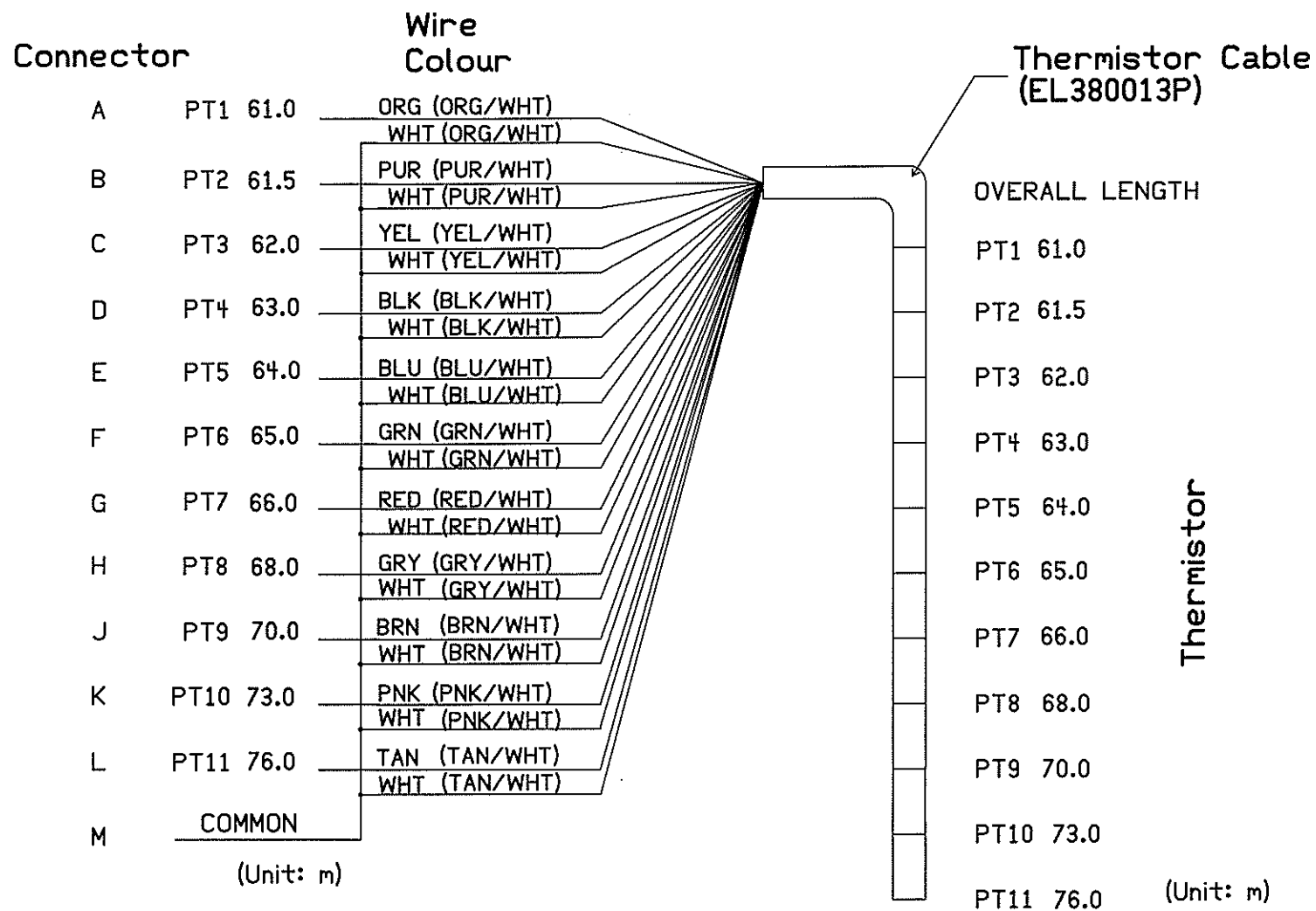


S/N: TS3087

ID: ND-VTS-085-US



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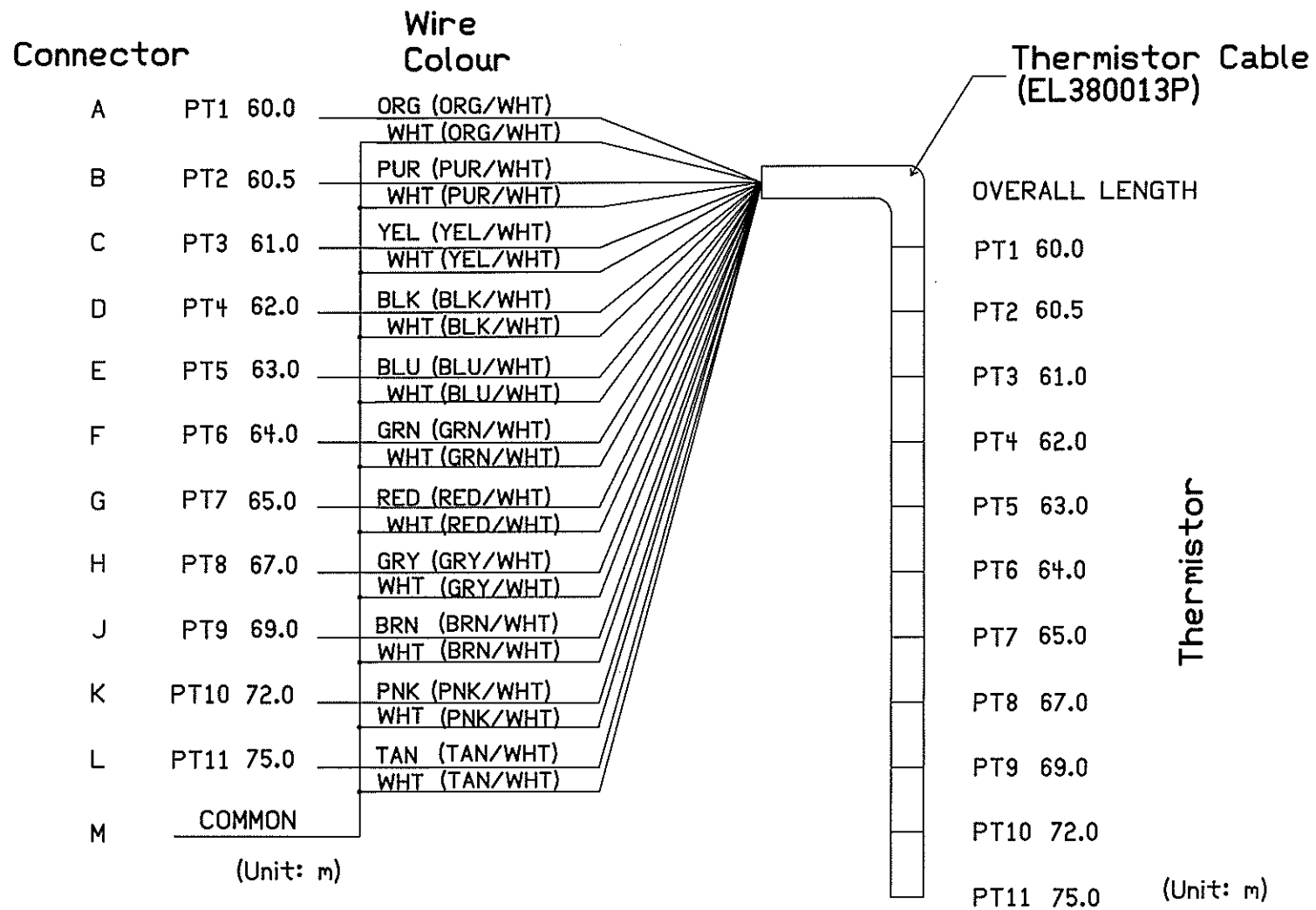


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ID: ND-VTS-085-DS



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Author:	CB	Size:	A
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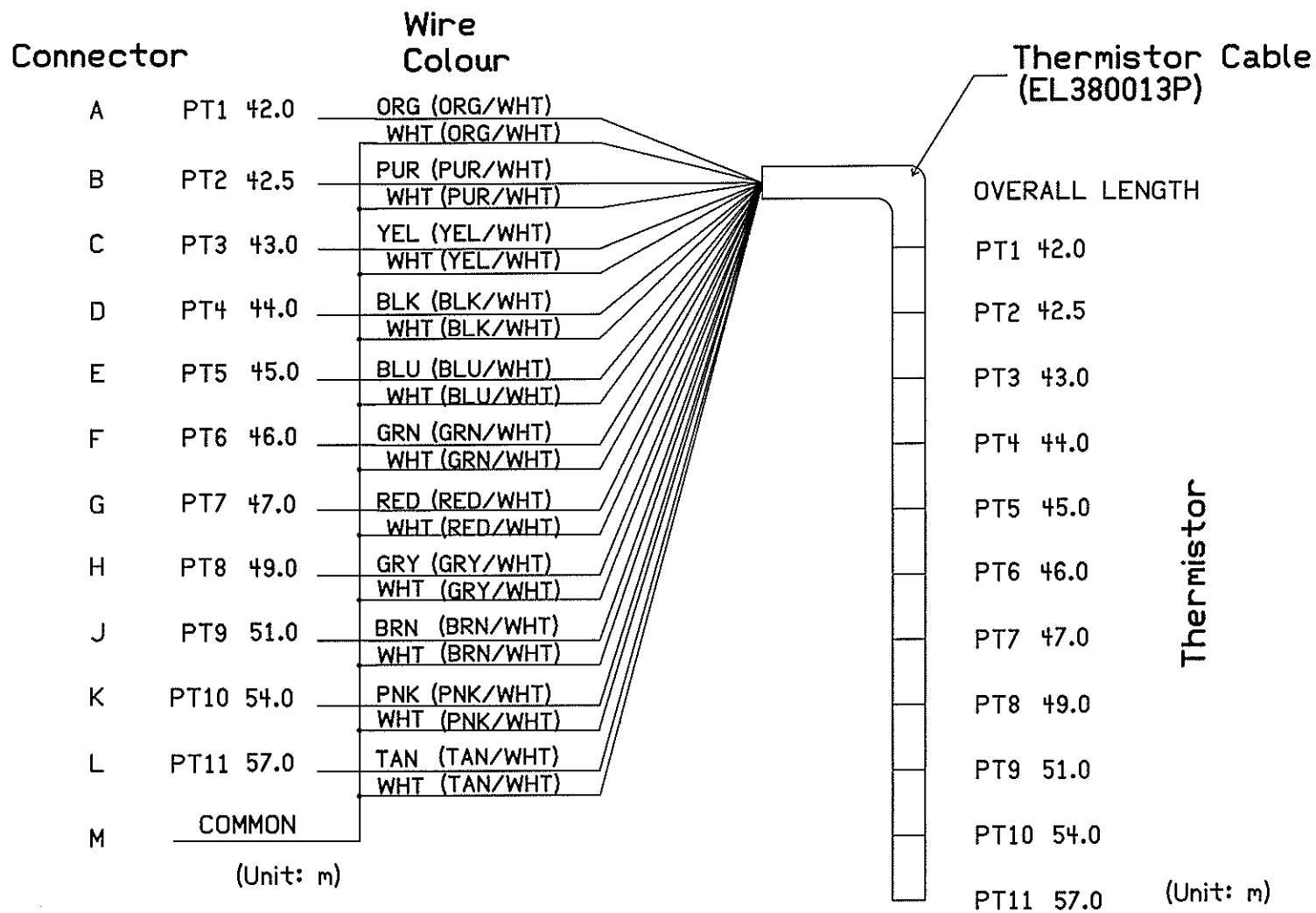


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ID: ND-VTS-130-US




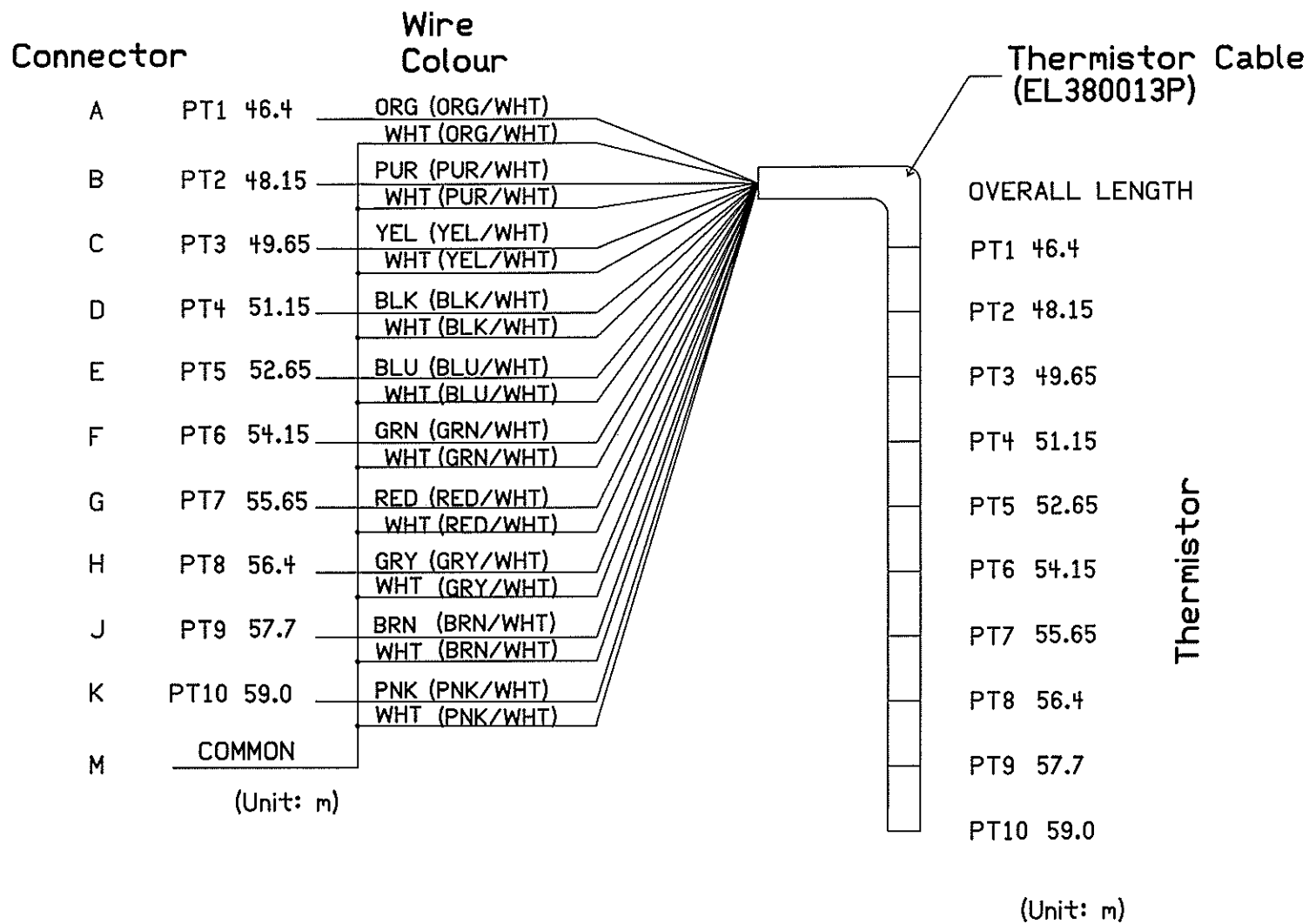
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J/N:	WQQ018560-10	Revision:	A
Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1



S/N: TS3090

ID: ND-VTS-130-DS

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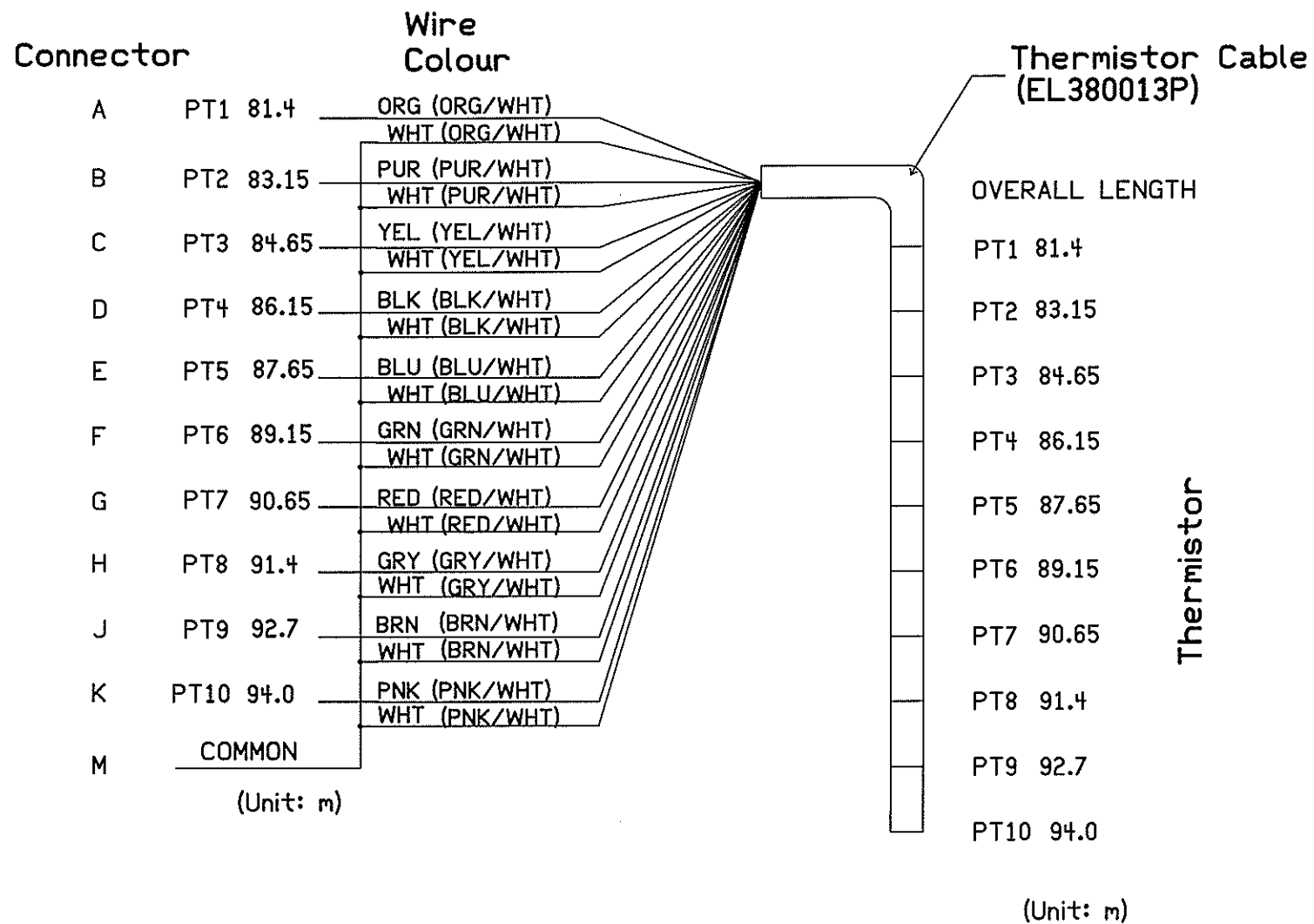


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ID: ND-HTS-040-31.5




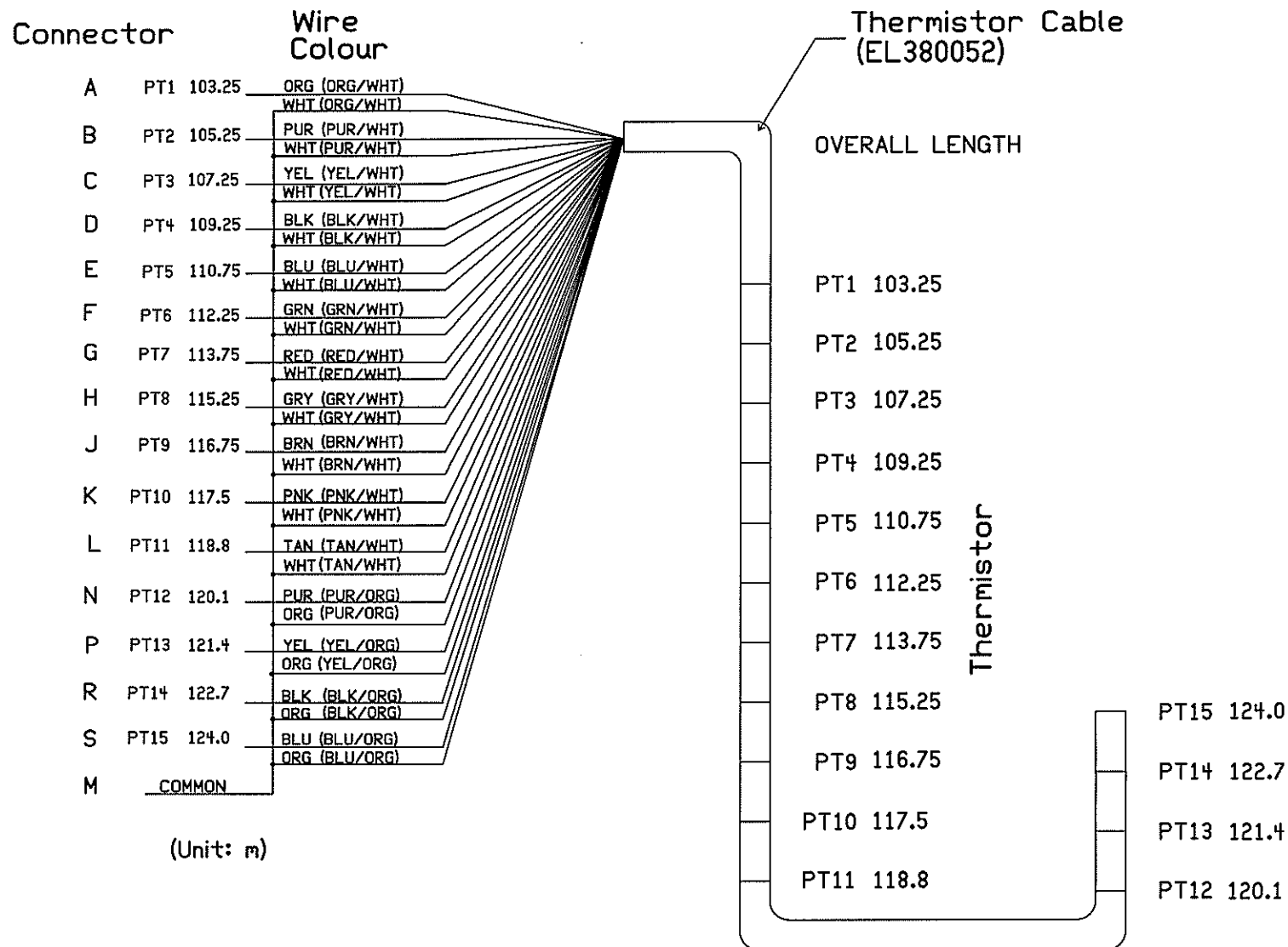
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Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1



S/N: TS3092

ID: ND-HTS-060-28.8


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	Date:	2010/10/12	Sheet	1 of 1

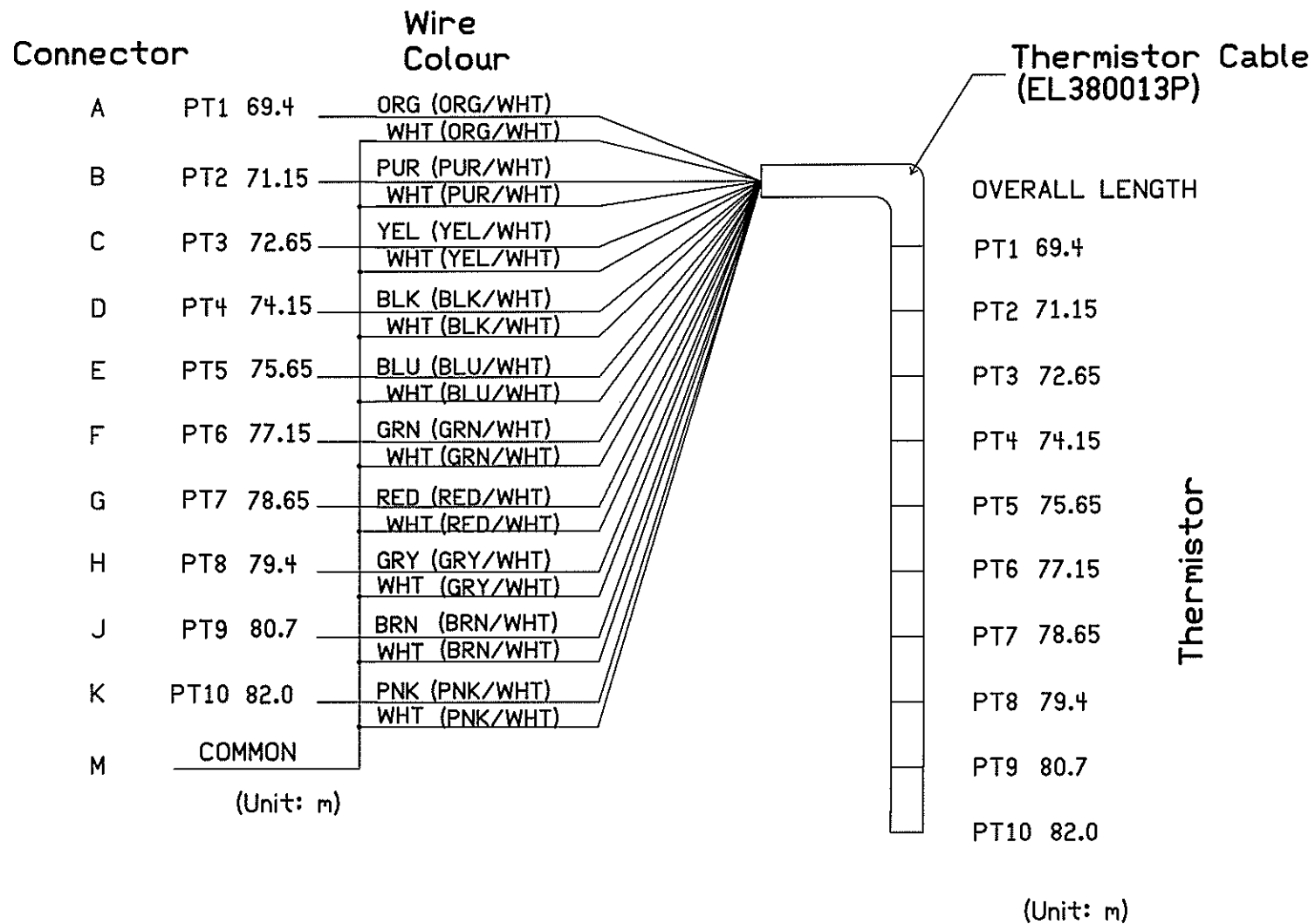


(Unit: m)

S/N: TS3093


ID: ND-HTS-085-25.3

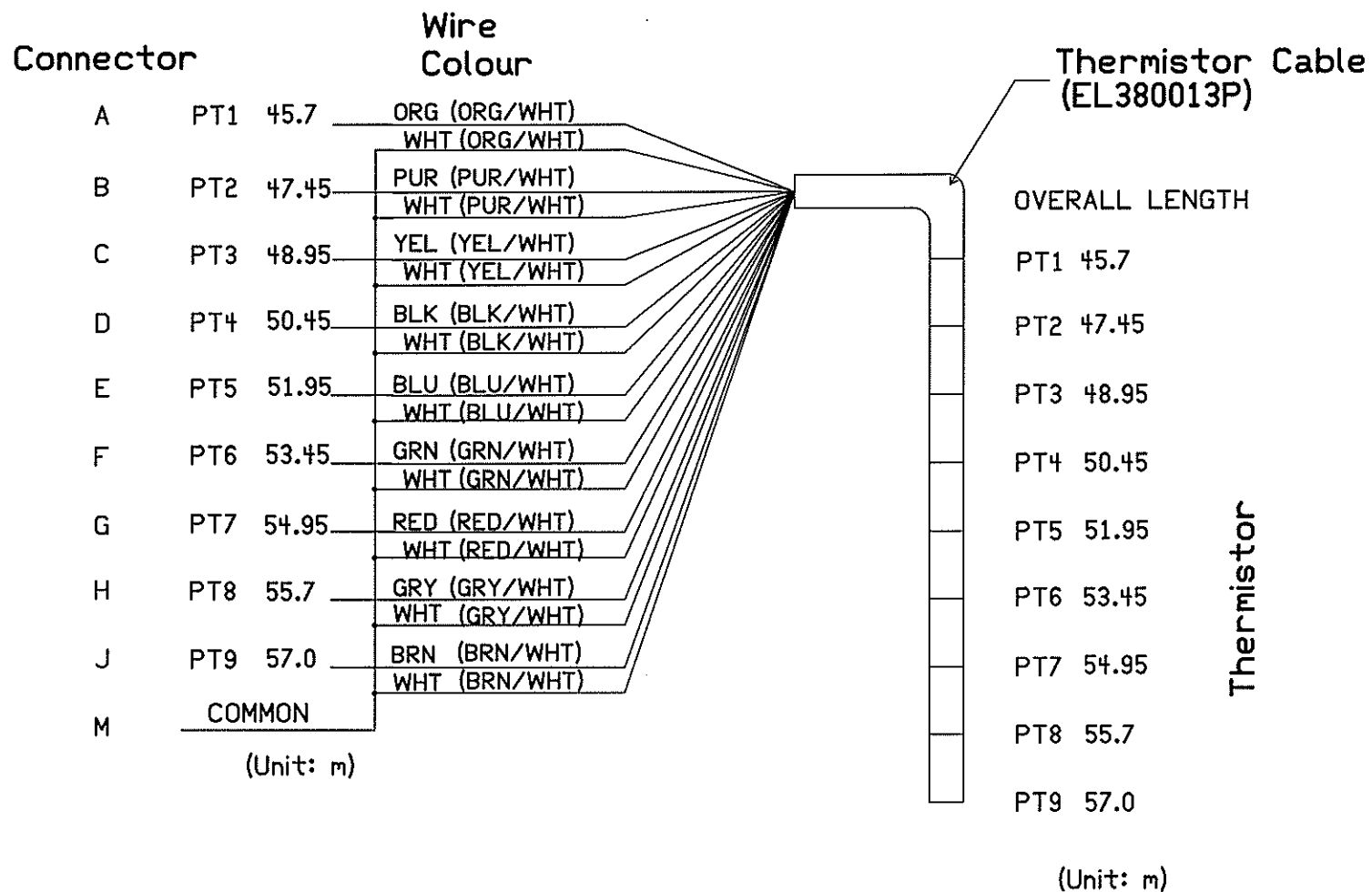
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	Author:	CB	Size: A
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S/N: TS3094


ID: ND-HTS-130-28.8

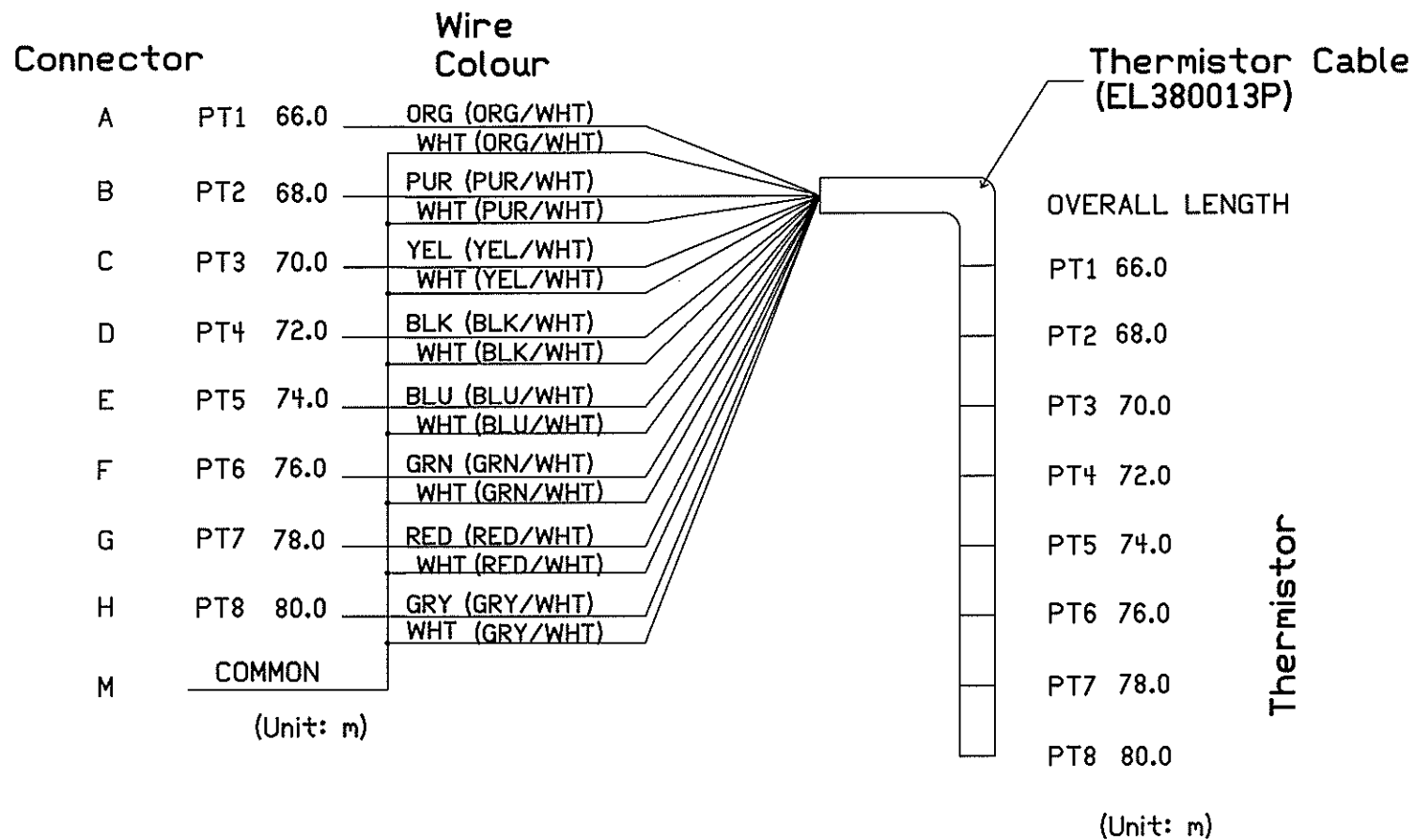
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S/N: TS3095


ID: ND-HTS-175-32.5

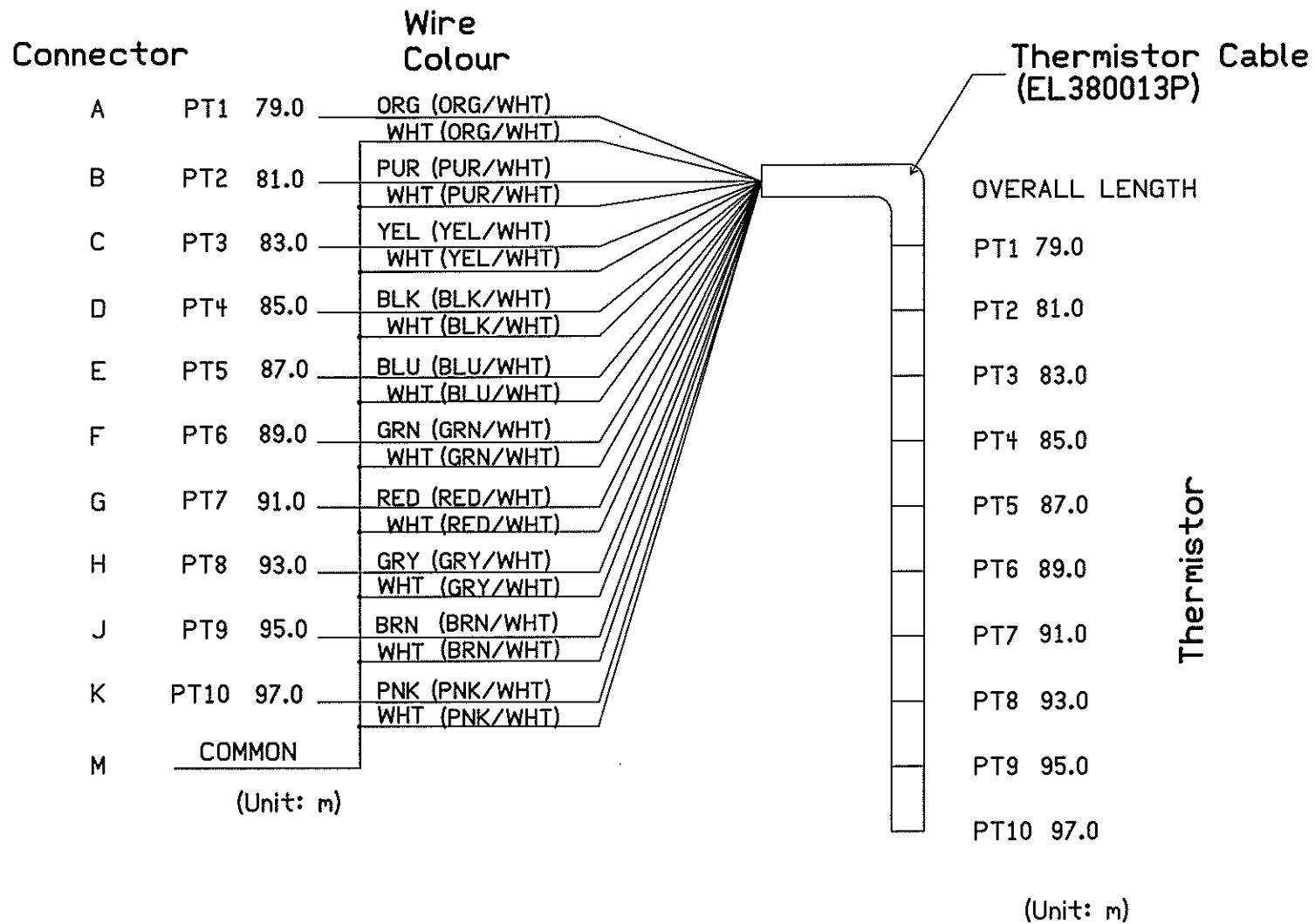
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S/N: TS3096

ID: ND-HTS-060-31.0

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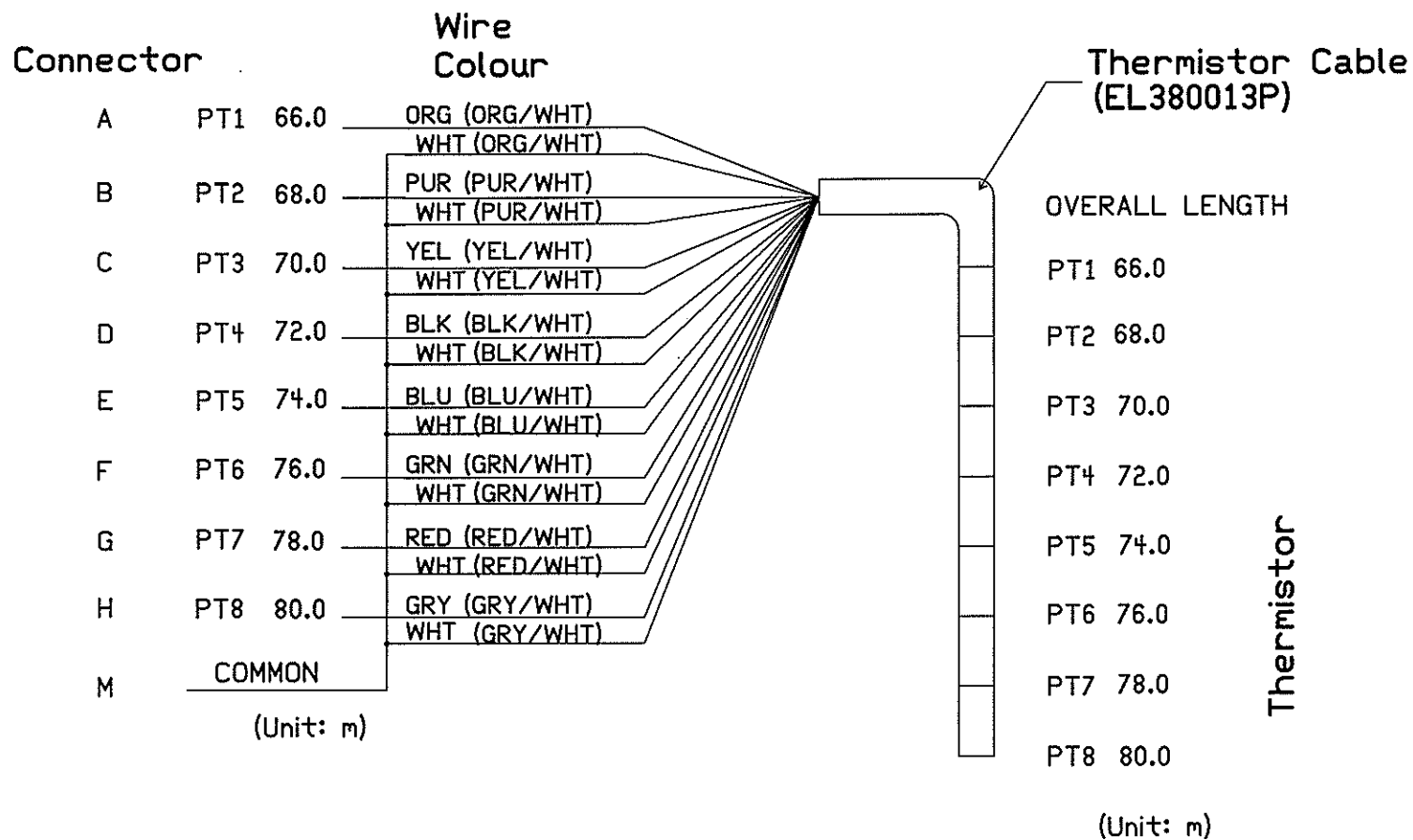


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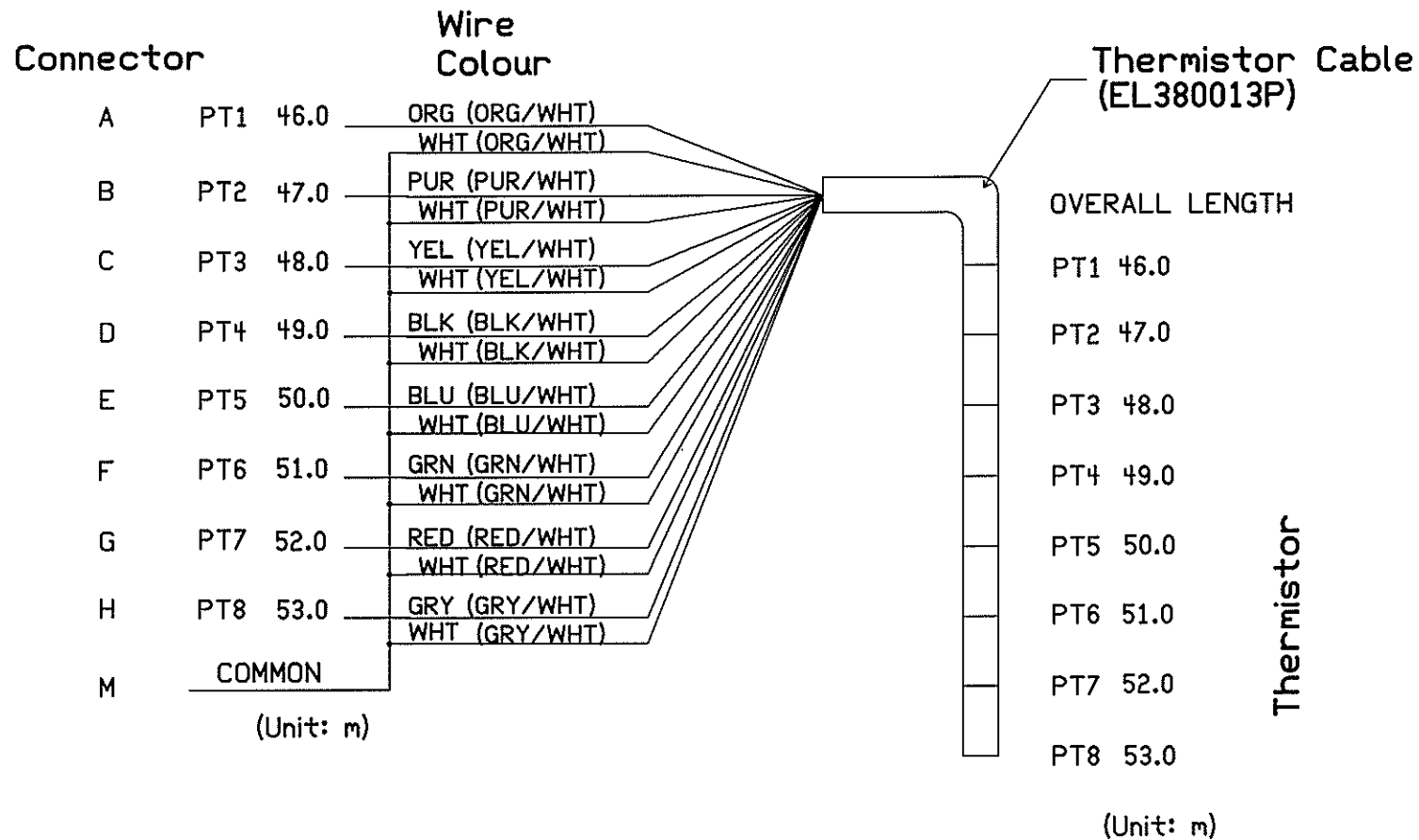
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Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1



S/N: TS3098


ID: ND-HTS-130-31.0

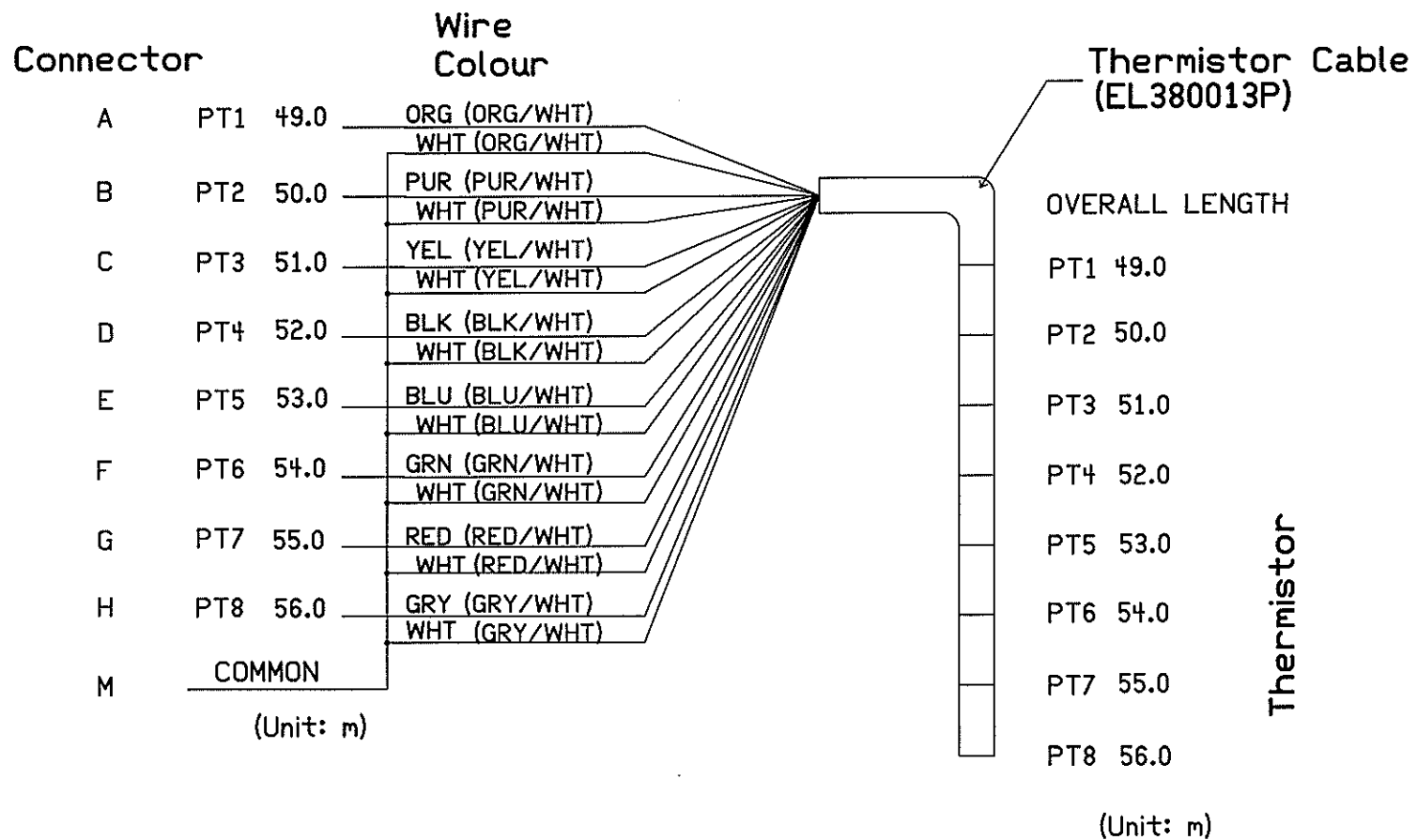
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	Date:	2010/10/12	Sheet	1 of 1



S/N: TS3099


ID: ND-HTS-060-33.5

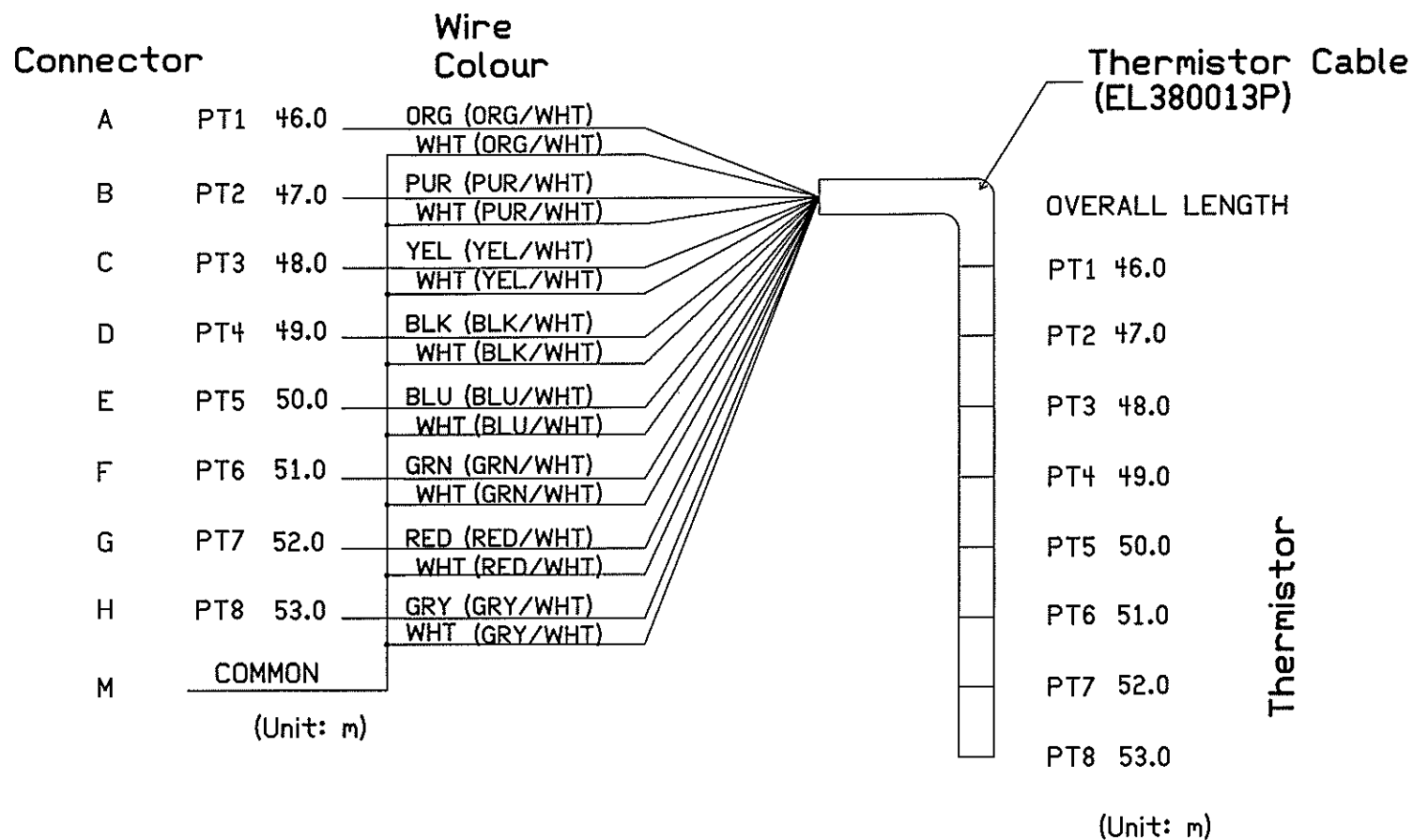
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	Author:	CB	Size:	A
	Date:	2010/10/12	Sheet	1 of 1



S/N: TS3102

ID: ND-HTS-040-33.5

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	J/N:	WOQ018560-21	Revision:	A
	Author:	CB	Size:	A
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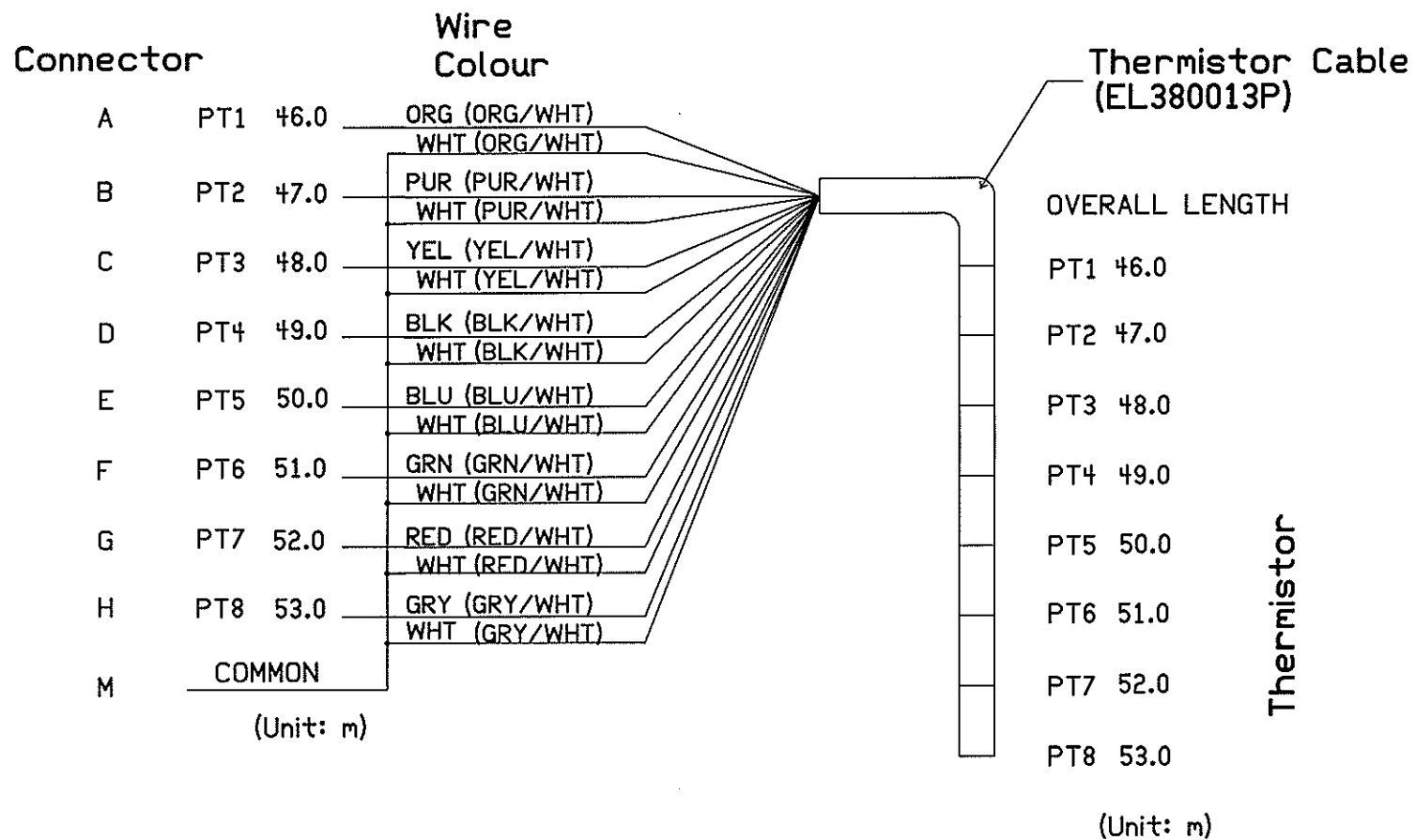


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ID: ND-HTS-085-33.5




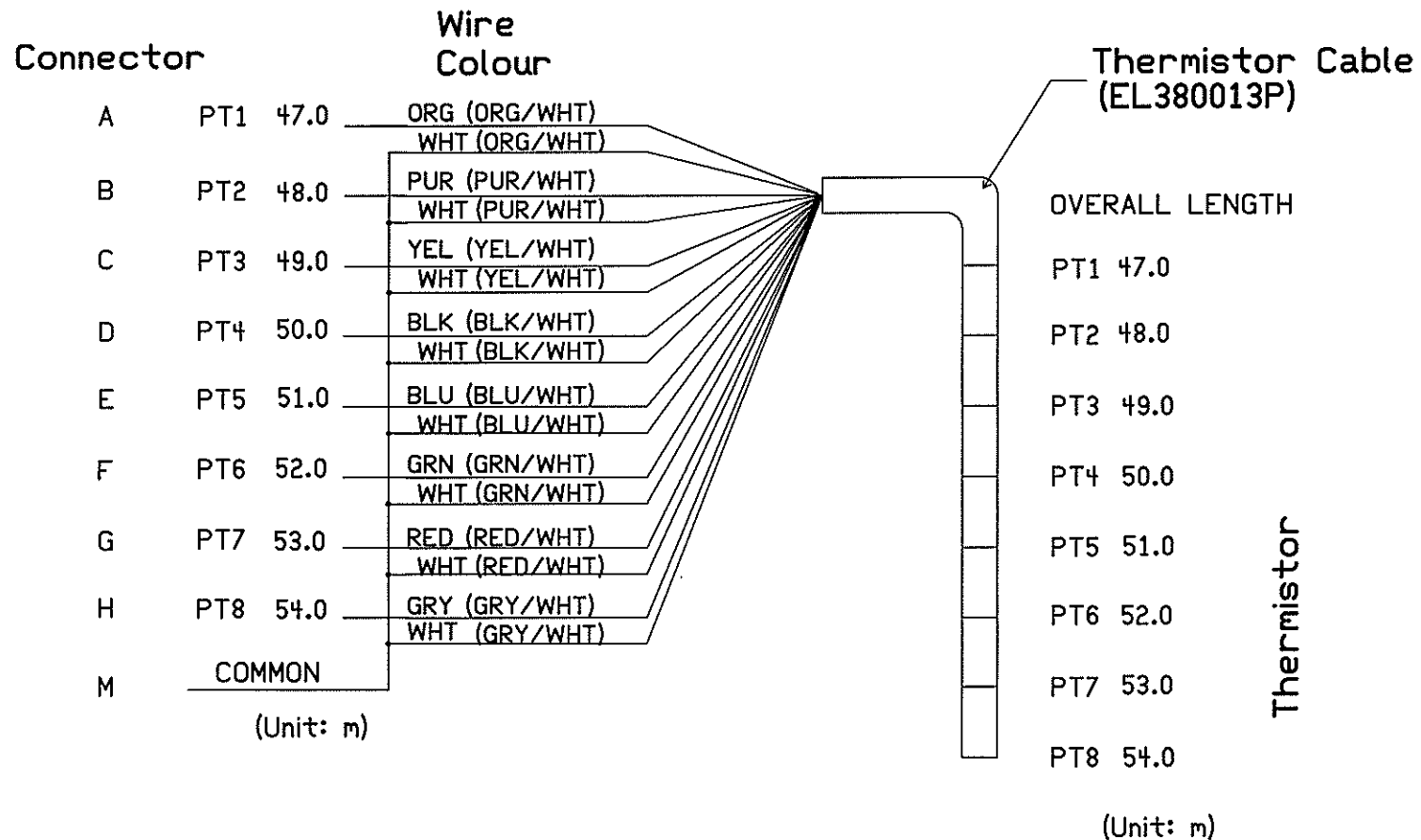
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J/N:	WOQ018560-22	Revision:	A
Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1



S/N: TS3101

ID: ND-HTS-130-33.5

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Date:		2010/10/12	Sheet 1 of 1



S/N: TS3103

ID: ND-HTS-175-33.5



Co:	RST INSTRUMENTS LTD		
Title:	THERMISTOR CABLE		
J/N:	WOQ018560-24	Revision:	A
Author:	CB	Size:	A
Date:	2010/10/12	Sheet	1 of 1

## **Appendix L.3: Download Procedures**

---

# North Dam Ground Temperature Download Procedure

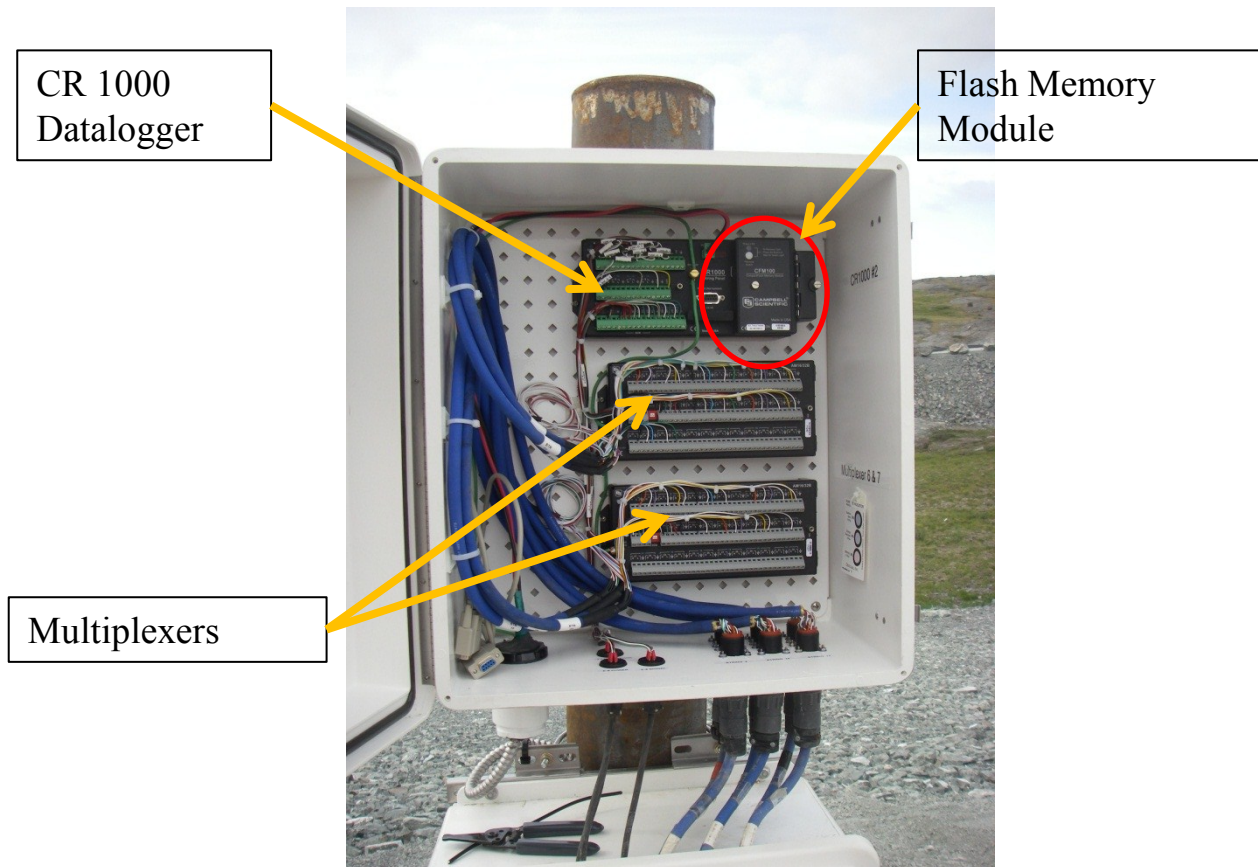
This document outlines the data download, transfer, and pre-processing procedure pertaining to the ground temperature monitoring at the North Dam.



It is recommended that data be downloaded at least twice every year, once at the beginning and once at the end of the summer season.

The 12 volt batteries powering the data acquisition system shall be removed and charged at least once every year, at the end of the monitoring season, in preparation for winter operation. Failure to do so may result in loss of data.

Please follow the step-by-step procedure as outlined below:

## 1. Open the weatherproof enclosure and find the datalogger.



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# North Dam Ground Temperature Download Procedure - continued

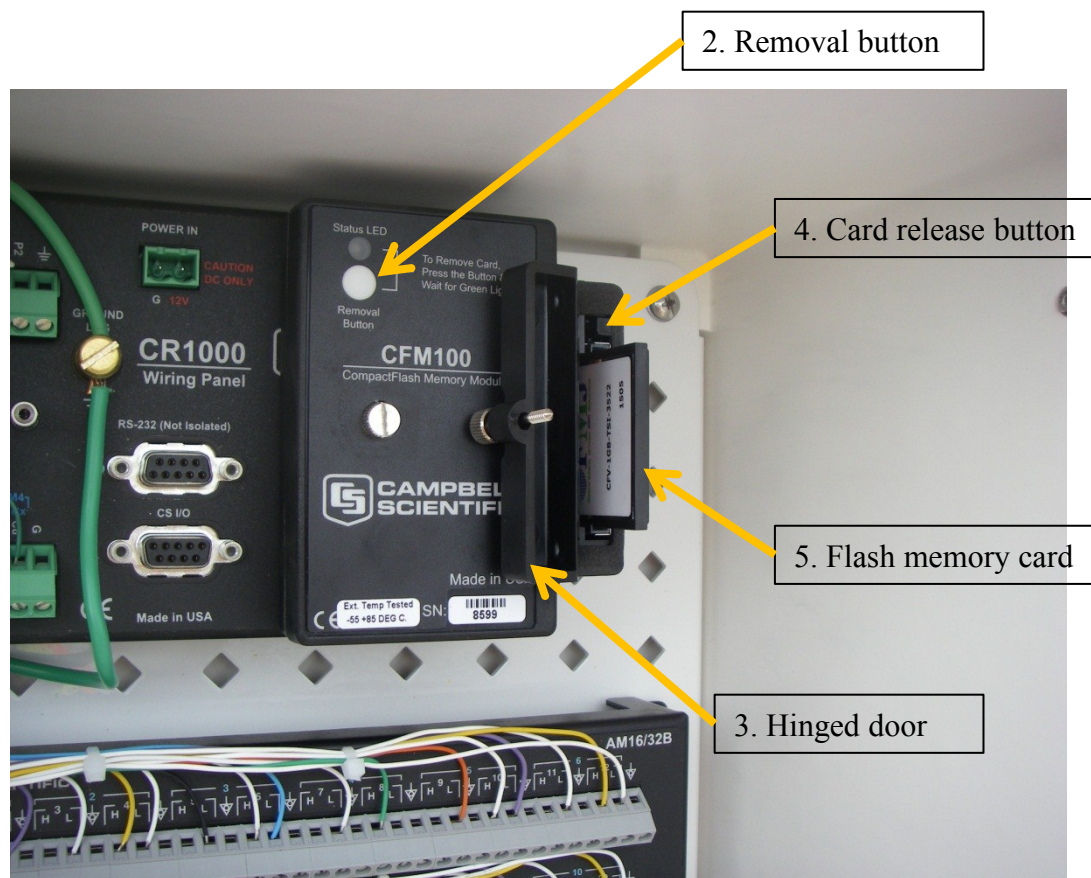
**2. Push** the removal button (white button on the upper left corner) and wait for green light. This may take a few seconds.



**3.** Once the solid green light is on, **open** the flash card cover hinged door. You will have to unscrew the securing screw first.

**4. Press** the card release button (small square button above the card) and remove the flash card.

**5. Place** the exchange card into the flash card slot and close and secure the hinged door. Make sure the correct card (marked as CR1000 #1 or CR1000 #2) is placed into each individual datalogger. Failing to do so may cause an error in the program and the data will not be written to the card, in which case the data will have to be retrieved by connecting a laptop computer directly to the datalogger.

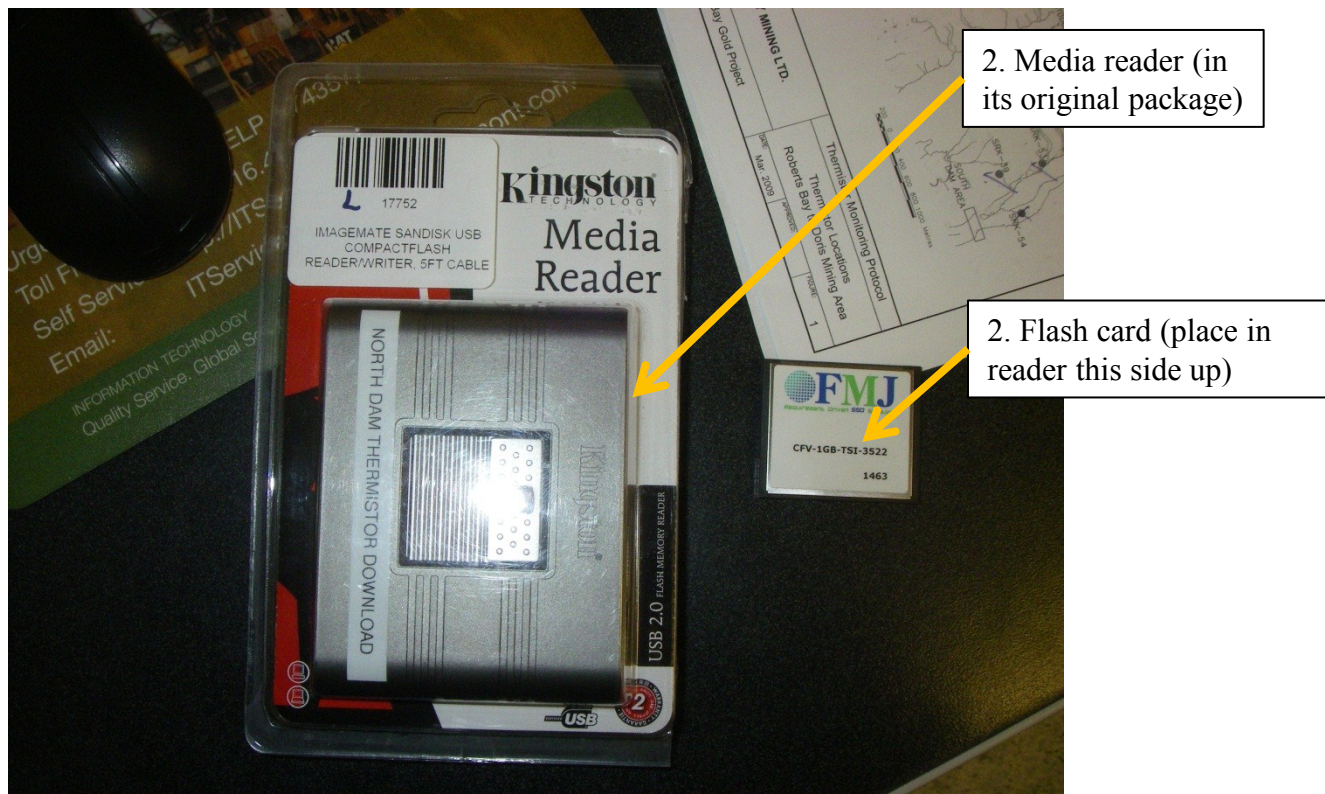
**6. Close** the hinged door and hand-tighten the securing screw. There is no need for any tools.



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**7. Insert** the card into the appropriate slot of the Media Reader, and then connect the reader to your computer. Copy the files from the card and send them to SRK by email.



The file names should be similar to the examples below:

“HB\_NorthDam\_CR1000\_#n.Daily\_Samples\_YYYY\_MM\_DD\_HHmm.dat”

“HB\_NorthDam\_CR1000\_#n.StationStatus\_YYYY\_MM\_DD\_HHmm.dat”

Where the italic characters are generic placeholders for the following parameters:



*n* - datalogger number (either 1 or 2)

YYYY – year

MM – month of the year

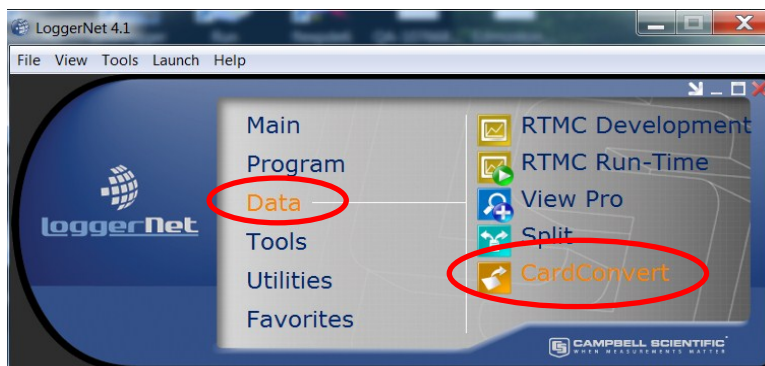
DD – day of the month

HHmm – hour and minute the file was created (time of first data transfer onto the card, i.e. the time the card was placed into the memory module)

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**8. If the files are too large** to be sent by email, some pre-processing is required. In this case, open LoggerNet and from the “Data” menu choose the “Card Convert” option

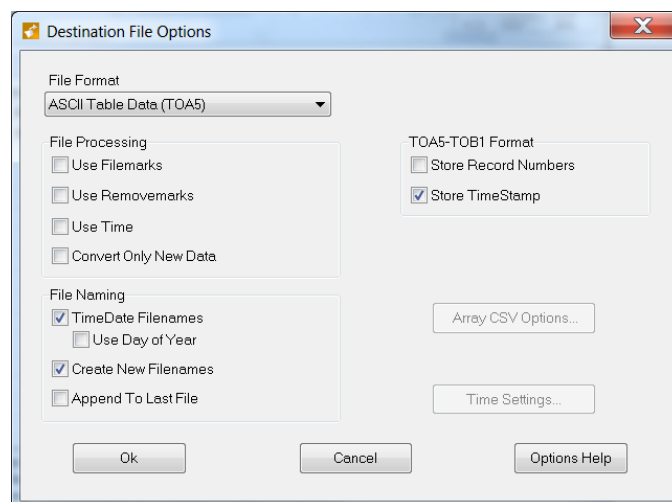
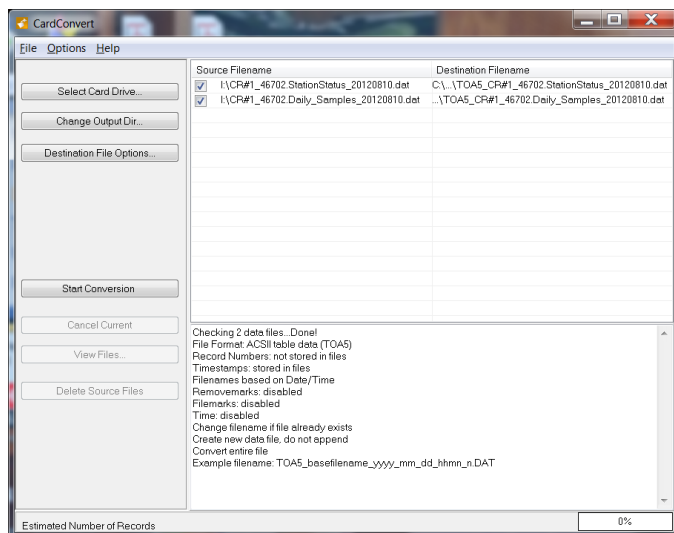




**9. Select the correct card drive** by clicking on the “Select Card Drive” button and browsing to the appropriate drive on your computer. Select the files to be pre-processed. There should always be 2 files created at the same time. Select them both.

**10. Select the output directory** for the processed files. It is recommended to create a folder directory dedicated to the field data on the C:\ drive. That way the data is backed up on your computer.

**11. Select the ASCII Table Data (TOA5)** format for the output file from the “Destination Files Options” screen. Make sure to tick off the “TimeDate Filenames”, “Create New Filenames”, and “Store Time Stamp” options.

**12. Send the TOA5 output files to SRK by email.**



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## **Appendix L.4: Program Listing**

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'CR1000 Series Datalogger

'Contact: Iozsef Miskolczi  
'SRK Consulting  
'2200-1066 West Hastings Street  
'Vancouver, BC, V6E 3X2  
'Canada

'Phone: 604-681-4196  
'Direct Number: 778-785-8460  
'email: IMiskolczi@srk.com

'Program overview: **CR1000 #1 Station Program**

'This program will take temperature measurements on a dam located  
'on Hope bay, Nunavut.

' Data will be stored on a compact flash card once every 6 hours

\*\*\*\*\*

'Program author: Mike Ryder - Sales & Technical Support  
' modified by Iozsef Miskolczi on August 11, 2012

'Campbell Scientific (Canada) Corp.  
'11564 - 149 Street NW  
'Edmonton, AB T5M 1W7  
'Canada

'Main Phone: 780-454-2505  
'Direct Number: 780-733-8214  
'Fax: 780-454-2655  
'Email: Mike.Ryder@campbellsci.ca  
'General Email: dataloggers@campbellsci.ca  
'Web Site: [www.campbellsci.ca](http://www.campbellsci.ca)

\*\*\*\*\*

'=====

'----- CR1000 Wiring -----

'=====

'=====

'----- Variables -----

'=====

Public PTemp  
Public batt\_volt

Public Therm\_ResA\_1 (34)  
Public Therm\_mV\_A\_1 (34)  
Public Therm\_TempA\_1 (34)

Public Therm\_ResB\_2 (36)  
Public Therm\_mV\_B\_2 (36)  
Public Therm\_TempB\_2 (36)

Public Therm\_ResB\_3 (30)

Public Therm\_mV\_B\_3 (30)  
Public Therm\_TempB\_3 (30)

Public Therm\_ResC\_4 (36)  
Public Therm\_mV\_C\_4 (36)  
Public Therm\_TempC\_4 (36)

Public Therm\_ResC\_5 (36)  
Public Therm\_mV\_C\_5 (36)  
Public Therm\_TempC\_5 (36)

Dim Index  
Dim Index2  
Dim Index3  
Dim Index4  
Dim Index5

StationName (HB\_NorthDam\_CR1000\_#1)

```
'=====
'- - - - - Variable aliases - - - - -
'=====
```

Alias Therm\_TempA\_1 (1) = ND\_VTS\_040\_KT\_PT1  
Alias Therm\_TempA\_1 (2) = ND\_VTS\_040\_KT\_PT2  
Alias Therm\_TempA\_1 (3) = ND\_VTS\_040\_KT\_PT3  
Alias Therm\_TempA\_1 (4) = ND\_VTS\_040\_KT\_PT4  
Alias Therm\_TempA\_1 (5) = ND\_VTS\_040\_KT\_PT5  
Alias Therm\_TempA\_1 (6) = ND\_VTS\_040\_KT\_PT6  
Alias Therm\_TempA\_1 (7) = ND\_VTS\_040\_KT\_PT7  
Alias Therm\_TempA\_1 (8) = ND\_VTS\_040\_KT\_PT8  
Alias Therm\_TempA\_1 (9) = ND\_VTS\_040\_KT\_PT9  
Alias Therm\_TempA\_1 (10) = ND\_VTS\_040\_KT\_PT10  
Alias Therm\_TempA\_1 (11) = ND\_VTS\_040\_KT\_PT11

Alias Therm\_TempA\_1 (13) = ND\_HTS\_040\_315\_PT1  
Alias Therm\_TempA\_1 (14) = ND\_HTS\_040\_315\_PT2  
Alias Therm\_TempA\_1 (15) = ND\_HTS\_040\_315\_PT3  
Alias Therm\_TempA\_1 (16) = ND\_HTS\_040\_315\_PT4  
Alias Therm\_TempA\_1 (17) = ND\_HTS\_040\_315\_PT5  
Alias Therm\_TempA\_1 (18) = ND\_HTS\_040\_315\_PT6  
Alias Therm\_TempA\_1 (19) = ND\_HTS\_040\_315\_PT7  
Alias Therm\_TempA\_1 (20) = ND\_HTS\_040\_315\_PT8  
Alias Therm\_TempA\_1 (21) = ND\_HTS\_040\_315\_PT9  
Alias Therm\_TempA\_1 (22) = ND\_HTS\_040\_315\_PT10

Alias Therm\_TempA\_1 (25) = ND\_HTS\_040\_335\_PT1  
Alias Therm\_TempA\_1 (26) = ND\_HTS\_040\_335\_PT2  
Alias Therm\_TempA\_1 (27) = ND\_HTS\_040\_335\_PT3  
Alias Therm\_TempA\_1 (28) = ND\_HTS\_040\_335\_PT4  
Alias Therm\_TempA\_1 (29) = ND\_HTS\_040\_335\_PT5  
Alias Therm\_TempA\_1 (30) = ND\_HTS\_040\_335\_PT6  
Alias Therm\_TempA\_1 (31) = ND\_HTS\_040\_335\_PT7  
Alias Therm\_TempA\_1 (32) = ND\_HTS\_040\_335\_PT8

Alias Therm\_TempB\_2 (1) = ND\_VTS\_060\_KT\_PT1

Alias Therm\_TempB\_2 (2) = ND\_VTS\_060\_KT\_PT2  
Alias Therm\_TempB\_2 (3) = ND\_VTS\_060\_KT\_PT3  
Alias Therm\_TempB\_2 (4) = ND\_VTS\_060\_KT\_PT4  
Alias Therm\_TempB\_2 (5) = ND\_VTS\_060\_KT\_PT5  
Alias Therm\_TempB\_2 (6) = ND\_VTS\_060\_KT\_PT6  
Alias Therm\_TempB\_2 (7) = ND\_VTS\_060\_KT\_PT7  
Alias Therm\_TempB\_2 (8) = ND\_VTS\_060\_KT\_PT8  
Alias Therm\_TempB\_2 (9) = ND\_VTS\_060\_KT\_PT9  
Alias Therm\_TempB\_2 (10) = ND\_VTS\_060\_KT\_PT10  
Alias Therm\_TempB\_2 (11) = ND\_VTS\_060\_KT\_PT11

Alias Therm\_TempB\_2 (13) = ND\_VTS\_060\_DS\_PT1  
Alias Therm\_TempB\_2 (14) = ND\_VTS\_060\_DS\_PT2  
Alias Therm\_TempB\_2 (15) = ND\_VTS\_060\_DS\_PT3  
Alias Therm\_TempB\_2 (16) = ND\_VTS\_060\_DS\_PT4  
Alias Therm\_TempB\_2 (17) = ND\_VTS\_060\_DS\_PT5  
Alias Therm\_TempB\_2 (18) = ND\_VTS\_060\_DS\_PT6  
Alias Therm\_TempB\_2 (19) = ND\_VTS\_060\_DS\_PT7  
Alias Therm\_TempB\_2 (20) = ND\_VTS\_060\_DS\_PT8  
Alias Therm\_TempB\_2 (21) = ND\_VTS\_060\_DS\_PT9  
Alias Therm\_TempB\_2 (22) = ND\_VTS\_060\_DS\_PT10  
Alias Therm\_TempB\_2 (23) = ND\_VTS\_060\_DS\_PT11

Alias Therm\_TempB\_2 (25) = ND\_HTS\_060\_288\_PT1  
Alias Therm\_TempB\_2 (26) = ND\_HTS\_060\_288\_PT2  
Alias Therm\_TempB\_2 (27) = ND\_HTS\_060\_288\_PT3  
Alias Therm\_TempB\_2 (28) = ND\_HTS\_060\_288\_PT4  
Alias Therm\_TempB\_2 (29) = ND\_HTS\_060\_288\_PT5  
Alias Therm\_TempB\_2 (30) = ND\_HTS\_060\_288\_PT6  
Alias Therm\_TempB\_2 (31) = ND\_HTS\_060\_288\_PT7  
Alias Therm\_TempB\_2 (32) = ND\_HTS\_060\_288\_PT8  
Alias Therm\_TempB\_2 (33) = ND\_HTS\_060\_288\_PT9  
Alias Therm\_TempB\_2 (34) = ND\_HTS\_060\_288\_PT10

Alias Therm\_TempB\_3 (1) = ND\_VTS\_060\_US\_PT1  
Alias Therm\_TempB\_3 (2) = ND\_VTS\_060\_US\_PT2  
Alias Therm\_TempB\_3 (3) = ND\_VTS\_060\_US\_PT3  
Alias Therm\_TempB\_3 (4) = ND\_VTS\_060\_US\_PT4  
Alias Therm\_TempB\_3 (5) = ND\_VTS\_060\_US\_PT5  
Alias Therm\_TempB\_3 (6) = ND\_VTS\_060\_US\_PT6  
Alias Therm\_TempB\_3 (7) = ND\_VTS\_060\_US\_PT7  
Alias Therm\_TempB\_3 (8) = ND\_VTS\_060\_US\_PT8  
Alias Therm\_TempB\_3 (9) = ND\_VTS\_060\_US\_PT9  
Alias Therm\_TempB\_3 (10) = ND\_VTS\_060\_US\_PT10  
Alias Therm\_TempB\_3 (11) = ND\_VTS\_060\_US\_PT11

Alias Therm\_TempB\_3 (13) = ND\_HTS\_060\_310\_PT1  
Alias Therm\_TempB\_3 (14) = ND\_HTS\_060\_310\_PT2  
Alias Therm\_TempB\_3 (15) = ND\_HTS\_060\_310\_PT3  
Alias Therm\_TempB\_3 (16) = ND\_HTS\_060\_310\_PT4  
Alias Therm\_TempB\_3 (17) = ND\_HTS\_060\_310\_PT5  
Alias Therm\_TempB\_3 (18) = ND\_HTS\_060\_310\_PT6  
Alias Therm\_TempB\_3 (19) = ND\_HTS\_060\_310\_PT7  
Alias Therm\_TempB\_3 (20) = ND\_HTS\_060\_310\_PT8

Alias Therm\_TempB\_3 (22) = ND\_HTS\_060\_335\_PT1

Alias Therm\_TempB\_3 (23) = ND\_HTS\_060\_335\_PT2  
Alias Therm\_TempB\_3 (24) = ND\_HTS\_060\_335\_PT3  
Alias Therm\_TempB\_3 (25) = ND\_HTS\_060\_335\_PT4  
Alias Therm\_TempB\_3 (26) = ND\_HTS\_060\_335\_PT5  
Alias Therm\_TempB\_3 (27) = ND\_HTS\_060\_335\_PT6  
Alias Therm\_TempB\_3 (28) = ND\_HTS\_060\_335\_PT7  
Alias Therm\_TempB\_3 (29) = ND\_HTS\_060\_335\_PT8

Alias Therm\_TempC\_4 (1) = ND\_VTS\_085\_KT\_PT1  
Alias Therm\_TempC\_4 (2) = ND\_VTS\_085\_KT\_PT2  
Alias Therm\_TempC\_4 (3) = ND\_VTS\_085\_KT\_PT3  
Alias Therm\_TempC\_4 (4) = ND\_VTS\_085\_KT\_PT4  
Alias Therm\_TempC\_4 (5) = ND\_VTS\_085\_KT\_PT5  
Alias Therm\_TempC\_4 (6) = ND\_VTS\_085\_KT\_PT6  
Alias Therm\_TempC\_4 (7) = ND\_VTS\_085\_KT\_PT7  
Alias Therm\_TempC\_4 (8) = ND\_VTS\_085\_KT\_PT8  
Alias Therm\_TempC\_4 (9) = ND\_VTS\_085\_KT\_PT9  
Alias Therm\_TempC\_4 (10) = ND\_VTS\_085\_KT\_PT10  
Alias Therm\_TempC\_4 (11) = ND\_VTS\_085\_KT\_PT11

Alias Therm\_TempC\_4 (13) = ND\_VTS\_085\_US\_PT1  
Alias Therm\_TempC\_4 (14) = ND\_VTS\_085\_US\_PT2  
Alias Therm\_TempC\_4 (15) = ND\_VTS\_085\_US\_PT3  
Alias Therm\_TempC\_4 (16) = ND\_VTS\_085\_US\_PT4  
Alias Therm\_TempC\_4 (17) = ND\_VTS\_085\_US\_PT5  
Alias Therm\_TempC\_4 (18) = ND\_VTS\_085\_US\_PT6  
Alias Therm\_TempC\_4 (19) = ND\_VTS\_085\_US\_PT7  
Alias Therm\_TempC\_4 (20) = ND\_VTS\_085\_US\_PT8  
Alias Therm\_TempC\_4 (21) = ND\_VTS\_085\_US\_PT9  
Alias Therm\_TempC\_4 (22) = ND\_VTS\_085\_US\_PT10  
Alias Therm\_TempC\_4 (23) = ND\_VTS\_085\_US\_PT11

Alias Therm\_TempC\_4 (25) = ND\_VTS\_085\_DS\_PT1  
Alias Therm\_TempC\_4 (26) = ND\_VTS\_085\_DS\_PT2  
Alias Therm\_TempC\_4 (27) = ND\_VTS\_085\_DS\_PT3  
Alias Therm\_TempC\_4 (28) = ND\_VTS\_085\_DS\_PT4  
Alias Therm\_TempC\_4 (29) = ND\_VTS\_085\_DS\_PT5  
Alias Therm\_TempC\_4 (30) = ND\_VTS\_085\_DS\_PT6  
Alias Therm\_TempC\_4 (31) = ND\_VTS\_085\_DS\_PT7  
Alias Therm\_TempC\_4 (32) = ND\_VTS\_085\_DS\_PT8  
Alias Therm\_TempC\_4 (33) = ND\_VTS\_085\_DS\_PT9  
Alias Therm\_TempC\_4 (34) = ND\_VTS\_085\_DS\_PT10  
Alias Therm\_TempC\_4 (35) = ND\_VTS\_085\_DS\_PT11

Alias Therm\_TempC\_5 (1) = ND\_HTS\_085\_253\_PT1  
Alias Therm\_TempC\_5 (2) = ND\_HTS\_085\_253\_PT2  
Alias Therm\_TempC\_5 (3) = ND\_HTS\_085\_253\_PT3  
Alias Therm\_TempC\_5 (4) = ND\_HTS\_085\_253\_PT4  
Alias Therm\_TempC\_5 (5) = ND\_HTS\_085\_253\_PT5  
Alias Therm\_TempC\_5 (6) = ND\_HTS\_085\_253\_PT6  
Alias Therm\_TempC\_5 (7) = ND\_HTS\_085\_253\_PT7  
Alias Therm\_TempC\_5 (8) = ND\_HTS\_085\_253\_PT8  
Alias Therm\_TempC\_5 (9) = ND\_HTS\_085\_253\_PT9  
Alias Therm\_TempC\_5 (10) = ND\_HTS\_085\_253\_PT10  
Alias Therm\_TempC\_5 (11) = ND\_HTS\_085\_253\_PT11  
Alias Therm\_TempC\_5 (12) = ND\_HTS\_085\_253\_PT12

Alias Therm\_TempC\_5 (13) = ND\_HTS\_085\_253\_PT13  
Alias Therm\_TempC\_5 (14) = ND\_HTS\_085\_253\_PT14  
Alias Therm\_TempC\_5 (15) = ND\_HTS\_085\_253\_PT15

Alias Therm\_TempC\_5 (16) = ND\_HTS\_085\_294\_PT1  
Alias Therm\_TempC\_5 (17) = ND\_HTS\_085\_294\_PT2  
Alias Therm\_TempC\_5 (18) = ND\_HTS\_085\_294\_PT3  
Alias Therm\_TempC\_5 (19) = ND\_HTS\_085\_294\_PT4  
Alias Therm\_TempC\_5 (20) = ND\_HTS\_085\_294\_PT5  
Alias Therm\_TempC\_5 (21) = ND\_HTS\_085\_294\_PT6  
Alias Therm\_TempC\_5 (22) = ND\_HTS\_085\_294\_PT7  
Alias Therm\_TempC\_5 (23) = ND\_HTS\_085\_294\_PT8  
Alias Therm\_TempC\_5 (24) = ND\_HTS\_085\_294\_PT9  
Alias Therm\_TempC\_5 (25) = ND\_HTS\_085\_294\_PT10

Alias Therm\_TempC\_5 (28) = ND\_HTS\_085\_335\_PT1  
Alias Therm\_TempC\_5 (29) = ND\_HTS\_085\_335\_PT2  
Alias Therm\_TempC\_5 (30) = ND\_HTS\_085\_335\_PT3  
Alias Therm\_TempC\_5 (31) = ND\_HTS\_085\_335\_PT4  
Alias Therm\_TempC\_5 (32) = ND\_HTS\_085\_335\_PT5  
Alias Therm\_TempC\_5 (33) = ND\_HTS\_085\_335\_PT6  
Alias Therm\_TempC\_5 (34) = ND\_HTS\_085\_335\_PT7  
Alias Therm\_TempC\_5 (35) = ND\_HTS\_085\_335\_PT8

```
'=====
'- - - - - Declare Constants - - - - -
'=====
```

```
' Thermistor constants 3000Ohm @ 25C thermistor
Const ConstC0 = 0.0014051
Const ConstC1 = 0.0002369
Const ConstC2 = 0.0000001019
```

```
'=====
'- - - - - Data Tables - - - - -
'=====
```

```
'Define Data Tables
```

```
DataTable (StationStatus,1,-1)
  DataInterval (0,6,hr,10)
  CardOut (0, -1000)
  Minimum (1,batt_volt,FP2,0,False)
  Sample (1,PTemp,FP2)
EndTable
```

```
DataTable (Daily_Samples,1,-1)
  DataInterval (0,6,hr,10)
  CardOut (0,-1000)
```

```
Sample (11,ND_VTS_040_KT_PT1,FP2)
Sample (10,ND_HTS_040_315_PT1,FP2)
Sample (8,ND_HTS_040_335_PT1,FP2)
```

```
Sample (11,ND_VTS_060_KT_PT1,FP2)
Sample (11,ND_VTS_060_DS_PT1,FP2)
Sample (10,ND_HTS_060_288_PT1,FP2)
```

Sample (11,ND\_VTS\_060\_US\_PT1,FP2)  
Sample (8,ND\_HTS\_060\_310\_PT1,FP2)  
Sample (8,ND\_HTS\_060\_335\_PT1,FP2)

Sample (11,ND\_VTS\_085\_KT\_PT1,FP2)  
Sample (11,ND\_VTS\_085\_US\_PT1,FP2)  
Sample (11,ND\_VTS\_085\_DS\_PT1,FP2)

Sample (15,ND\_HTS\_085\_253\_PT1,FP2)  
Sample (10,ND\_HTS\_085\_294\_PT1,FP2)  
Sample (8,ND\_HTS\_085\_335\_PT1,FP2)

EndTable

```
=====
- - - - - Main Program - - - - -
=====

BeginProg
Scan (6,hr,0,0)' 4 times daily, at midnight, 6AM, noon, 6PM
PanelTemp (PTemp,_60Hz)
Battery (batt_volt)
If TimeInToInterval (0,6,hr)
'-----
PortSet (1,1)'Turn On Node A_1 Multiplexer
Delay (0,150,msec)
PulsePort (2,10000)
'Multiplexer A_1
'Measurement conversions for Multiplexer A_1
'Calculate resistance for 32 thermistors
For Index = 1 To 36
BrHalf (Therm_mV_A_1(Index),3,mv2500C,1,Vx1,3,2500,True ,20000,_60Hz,1.0,0)
Index=Index+2
PulsePort (2,10000)
Next
PortSet (1,0)
'Multiplexer C_5
'Measurement conversions for Multiplexer C_5
'Calculate resistance for 35 thermistors
PortSet (1,1)'Turn On Node C_5 Multiplexer
Delay (0,150,msec)
PulsePort (2,10000)
For Index5 = 1 To 36
BrHalf (Therm_mV_C_5(Index5),3,mv2500C,13,Vx3,3,2500,True ,20000,_60Hz,1.0,0)
Index5=Index5+2
PulsePort (2,10000)
Next
PortSet (1,0)
'Turn Off Node A_1 and Node C_5 Multiplexer
'-----
PortSet (3,1)'Turn On Node B_2 Multiplexer
Delay (0,150,msec)
PulsePort (4,10000)
'Multiplexer B_2
'Measurement conversions for Multiplexer B_2
```

```

'Calculate resistance for 33 thermistors
For Index2 = 1 To 36
    BrHalf (Therm_mV_B_2(Index2),3,mv2500C,4,Vx1,3,2500,True ,20000,_60Hz,1.0,0)
    Index2=Index2+2
    PulsePort (4,10000)
Next
PortSet (3,0)'Turn Off Node B_2 Multiplexer
'-----
PortSet (5,1)'Turn On Node B_3 Multiplexer
Delay (0,150,msec)
PulsePort (6,10000)
'Multiplexer B_3
'Measurement conversions for Multiplexer B_3
'Calculate resistance for 33 thermistors
For Index3 = 1 To 30
    BrHalf (Therm_mV_B_3(Index3),3,mv2500C,7,Vx2,3,2500,True ,20000,_60Hz,1.0,0)
    Index3=Index3+2
    PulsePort (6,10000)
Next
PortSet (5,0)'Turn Off Node B_3 Multiplexer
'-----
PortSet (7,1)'Turn On Node C_4 Multiplexer
Delay (0,150,msec)
PulsePort (8,10000)
'Multiplexer B_3
'Measurement conversions for Multiplexer B_3
'Calculate resistance for 33 thermistors
For Index4 = 1 To 36
    BrHalf (Therm_mV_C_4(Index4),3,mv2500C,10,Vx2,3,2500,True ,20000,_60Hz,1.0,0)
    Index4=Index4+2
    PulsePort (8,10000)
Next
PortSet (7,0)'Turn Off Node C_4 Multiplexer
'-----

'Measurement conversions for Multiplexer A_1
For Index = 1 To 32
    ' Calculate resistance using equation :  $R_t = 10000 \cdot (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
    Therm_ResA_1(Index) = 10000*(1-Therm_mV_A_1(Index))/Therm_mV_A_1(Index)
    If Therm_ResA_1(Index) > 1000000 OR Therm_ResA_1(Index) < 0 Then Therm_ResA_1(Index) = 0
    'Calculate temperature of 35 thermistors using the steinhart-hart equation
    Therm_TempA_1(Index) =
    1/(ConstC0+ConstC1*LN(Therm_ResA_1(Index))+ConstC2*(LN(Therm_ResA_1(Index))^3))-273.15
Next

'Measurement conversions for Multiplexer B_2
For Index2 = 1 To 34
    ' Calculate resistance using equation :  $R_t = 10000 \cdot (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
    Therm_ResB_2(Index2) = 10000*(1-Therm_mV_B_2(Index2))/Therm_mV_B_2(Index2)
    If Therm_ResB_2(Index2) > 1000000 OR Therm_ResB_2(Index2) < 0 Then Therm_ResB_2(Index2) = 0
    'Calculate temperature of 35 thermistors using the steinhart-hart equation
    Therm_TempB_2(Index2) =
    1/(ConstC0+ConstC1*LN(Therm_ResB_2(Index2))+ConstC2*(LN(Therm_ResB_2(Index2))^3))-273.15
Next

```

```

'Measurement conversions for Multiplexer B_3
For Index3 = 1 To 29
  ' Calculate resistance using equation :  $R_t = 10000 * (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
  Therm_ResB_3(Index3) = 10000*(1-Therm_mV_B_3(Index3))/Therm_mV_B_3(Index3)
  If Therm_ResB_3(Index3) > 1000000 OR Therm_ResB_3(Index3) < 0 Then Therm_ResB_3(Index3) = 0

  'Calculate temperature of 35 thermistors using the steinhart-hart equation
  Therm_TempB_3(Index3) =
1/(ConstC0+ConstC1*LN(Therm_ResB_3(Index3))+ConstC2*(LN(Therm_ResB_3(Index3))^3))-273.15
Next

'Measurement conversions for Multiplexer C_4
For Index4 = 1 To 35
  ' Calculate resistance using equation :  $R_t = 10000 * (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
  Therm_ResC_4(Index4) = 10000*(1-Therm_mV_C_4(Index4))/Therm_mV_C_4(Index4)
  If Therm_ResC_4(Index4) > 1000000 OR Therm_ResC_4(Index4) < 0 Then Therm_ResC_4(Index4) = 0
  'Calculate temperature of 35 thermistors using the steinhart-hart equation
  Therm_TempC_4(Index4) =
1/(ConstC0+ConstC1*LN(Therm_ResC_4(Index4))+ConstC2*(LN(Therm_ResC_4(Index4))^3))-273.15
Next

'Measurement conversions for Multiplexer C_5
For Index5 = 1 To 35
  ' Calculate resistance using equation :  $R_t = 10000 * (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
  Therm_ResC_5(Index5) = 10000*(1-Therm_mV_C_5(Index5))/Therm_mV_C_5(Index5)
  If Therm_ResC_5(Index5) > 1000000 OR Therm_ResC_5(Index5) < 0 Then Therm_ResC_5(Index5) = 0
  'Calculate temperature of 35 thermistors using the steinhart-hart equation
  Therm_TempC_5(Index5) =
1/(ConstC0+ConstC1*LN(Therm_ResC_5(Index5))+ConstC2*(LN(Therm_ResC_5(Index5))^3))-273.15
Next

CallTable (Daily_Samples)
CallTable (StationStatus)
EndIf
NextScan
EndProg

```

'CR1000 Series Datalogger

'Company: SRK Consulting / Nuna Logistics

'Contact: SRK: Iozsef Miskolczi

'Program overview: **CR1000 #2 Station program**

'This program will take temperature measurements on a dam located  
'on Hope bay, Nunavut.

'Data will be stored on a compact flash card once every 6 hours

\*\*\*\*\*

'Program author: Mike Ryder - Sales & Technical Support

'Campbell Scientific (Canada) Corp.

'11564 - 149 Street NW

'Edmonton, AB T5M 1W7

'Canada

'Main Phone: 780-454-2505

'Direct Number: 780-733-8214

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'Email: Mike.Ryder@campbellsci.ca

'General Email: dataloggers@campbellsci.ca

'Web Site: [www.campbellsci.ca](http://www.campbellsci.ca)

\*\*\*\*\*

'=====

'- - - - - CR1000 Wiring - - - - -

'=====

'=====

'- - - - - Variables - - - - -

'=====

Public PTemp

Public batt\_volt

Public Therm\_ResD\_6 (36)

Public Therm\_mV\_D\_6 (36)

Public Therm\_TempD\_6 (36)

Public Therm\_ResD\_7 (30)

Public Therm\_mV\_D\_7 (30)

Public Therm\_TempD\_7 (30)

Public Therm\_ResE\_8 (30)

Public Therm\_mV\_E\_8 (30)

Public Therm\_TempE\_8 (30)

Public Therm\_109 (12)

Dim Index

Dim Index2

Dim Index3

Dim Index4

StationName (HB\_NorthDam\_CR1000\_#2)

```
'=====
'- - - - - Variable aliases - - - - -
'=====
```

Alias Therm\_TempD\_6 (1) = ND\_VTS\_130\_KT\_PT1  
Alias Therm\_TempD\_6 (2) = ND\_VTS\_130\_KT\_PT2  
Alias Therm\_TempD\_6 (3) = ND\_VTS\_130\_KT\_PT3  
Alias Therm\_TempD\_6 (4) = ND\_VTS\_130\_KT\_PT4  
Alias Therm\_TempD\_6 (5) = ND\_VTS\_130\_KT\_PT5  
Alias Therm\_TempD\_6 (6) = ND\_VTS\_130\_KT\_PT6  
Alias Therm\_TempD\_6 (7) = ND\_VTS\_130\_KT\_PT7  
Alias Therm\_TempD\_6 (8) = ND\_VTS\_130\_KT\_PT8  
Alias Therm\_TempD\_6 (9) = ND\_VTS\_130\_KT\_PT9  
Alias Therm\_TempD\_6 (10) = ND\_VTS\_130\_KT\_PT10  
Alias Therm\_TempD\_6 (11) = ND\_VTS\_130\_KT\_PT11

Alias Therm\_TempD\_6 (13) = ND\_VTS\_130\_US\_PT1  
Alias Therm\_TempD\_6 (14) = ND\_VTS\_130\_US\_PT2  
Alias Therm\_TempD\_6 (15) = ND\_VTS\_130\_US\_PT3  
Alias Therm\_TempD\_6 (16) = ND\_VTS\_130\_US\_PT4  
Alias Therm\_TempD\_6 (17) = ND\_VTS\_130\_US\_PT5  
Alias Therm\_TempD\_6 (18) = ND\_VTS\_130\_US\_PT6  
Alias Therm\_TempD\_6 (19) = ND\_VTS\_130\_US\_PT7  
Alias Therm\_TempD\_6 (20) = ND\_VTS\_130\_US\_PT8  
Alias Therm\_TempD\_6 (21) = ND\_VTS\_130\_US\_PT9  
Alias Therm\_TempD\_6 (22) = ND\_VTS\_130\_US\_PT10  
Alias Therm\_TempD\_6 (23) = ND\_VTS\_130\_US\_PT11

Alias Therm\_TempD\_6 (25) = ND\_VTS\_130\_DS\_PT1  
Alias Therm\_TempD\_6 (26) = ND\_VTS\_130\_DS\_PT2  
Alias Therm\_TempD\_6 (27) = ND\_VTS\_130\_DS\_PT3  
Alias Therm\_TempD\_6 (28) = ND\_VTS\_130\_DS\_PT4  
Alias Therm\_TempD\_6 (29) = ND\_VTS\_130\_DS\_PT5  
Alias Therm\_TempD\_6 (30) = ND\_VTS\_130\_DS\_PT6  
Alias Therm\_TempD\_6 (31) = ND\_VTS\_130\_DS\_PT7  
Alias Therm\_TempD\_6 (32) = ND\_VTS\_130\_DS\_PT8  
Alias Therm\_TempD\_6 (33) = ND\_VTS\_130\_DS\_PT9  
Alias Therm\_TempD\_6 (34) = ND\_VTS\_130\_DS\_PT10  
Alias Therm\_TempD\_6 (35) = ND\_VTS\_130\_DS\_PT11

Alias Therm\_TempD\_7 (1) = ND\_HTS\_130\_288\_PT1  
Alias Therm\_TempD\_7 (2) = ND\_HTS\_130\_288\_PT2  
Alias Therm\_TempD\_7 (3) = ND\_HTS\_130\_288\_PT3  
Alias Therm\_TempD\_7 (4) = ND\_HTS\_130\_288\_PT4  
Alias Therm\_TempD\_7 (5) = ND\_HTS\_130\_288\_PT5  
Alias Therm\_TempD\_7 (6) = ND\_HTS\_130\_288\_PT6  
Alias Therm\_TempD\_7 (7) = ND\_HTS\_130\_288\_PT7  
Alias Therm\_TempD\_7 (8) = ND\_HTS\_130\_288\_PT8  
Alias Therm\_TempD\_7 (9) = ND\_HTS\_130\_288\_PT9  
Alias Therm\_TempD\_7 (10) = ND\_HTS\_130\_288\_PT10

Alias Therm\_TempD\_7 (13) = ND\_HTS\_130\_310\_PT1  
Alias Therm\_TempD\_7 (14) = ND\_HTS\_130\_310\_PT2  
Alias Therm\_TempD\_7 (15) = ND\_HTS\_130\_310\_PT3  
Alias Therm\_TempD\_7 (16) = ND\_HTS\_130\_310\_PT4

Alias Therm\_TempD\_7 (17) = ND\_HTS\_130\_310\_PT5  
Alias Therm\_TempD\_7 (18) = ND\_HTS\_130\_310\_PT6  
Alias Therm\_TempD\_7 (19) = ND\_HTS\_130\_310\_PT7  
Alias Therm\_TempD\_7 (20) = ND\_HTS\_130\_310\_PT8

Alias Therm\_TempD\_7 (22) = ND\_HTS\_130\_335\_PT1  
Alias Therm\_TempD\_7 (23) = ND\_HTS\_130\_335\_PT2  
Alias Therm\_TempD\_7 (24) = ND\_HTS\_130\_335\_PT3  
Alias Therm\_TempD\_7 (25) = ND\_HTS\_130\_335\_PT4  
Alias Therm\_TempD\_7 (26) = ND\_HTS\_130\_335\_PT5  
Alias Therm\_TempD\_7 (27) = ND\_HTS\_130\_335\_PT6  
Alias Therm\_TempD\_7 (28) = ND\_HTS\_130\_335\_PT7  
Alias Therm\_TempD\_7 (29) = ND\_HTS\_130\_335\_PT8

Alias Therm\_TempE\_8 (1) = ND\_VTS\_175\_KT\_PT1  
Alias Therm\_TempE\_8 (2) = ND\_VTS\_175\_KT\_PT2  
Alias Therm\_TempE\_8 (3) = ND\_VTS\_175\_KT\_PT3  
Alias Therm\_TempE\_8 (4) = ND\_VTS\_175\_KT\_PT4  
Alias Therm\_TempE\_8 (5) = ND\_VTS\_175\_KT\_PT5  
Alias Therm\_TempE\_8 (6) = ND\_VTS\_175\_KT\_PT6  
Alias Therm\_TempE\_8 (7) = ND\_VTS\_175\_KT\_PT7  
Alias Therm\_TempE\_8 (8) = ND\_VTS\_175\_KT\_PT8  
Alias Therm\_TempE\_8 (9) = ND\_VTS\_175\_KT\_PT9  
Alias Therm\_TempE\_8 (10) = ND\_VTS\_175\_KT\_PT10  
Alias Therm\_TempE\_8 (11) = ND\_VTS\_175\_KT\_PT11

Alias Therm\_TempE\_8 (13) = ND\_HTS\_175\_325\_PT1  
Alias Therm\_TempE\_8 (14) = ND\_HTS\_175\_325\_PT2  
Alias Therm\_TempE\_8 (15) = ND\_HTS\_175\_325\_PT3  
Alias Therm\_TempE\_8 (16) = ND\_HTS\_175\_325\_PT4  
Alias Therm\_TempE\_8 (17) = ND\_HTS\_175\_325\_PT5  
Alias Therm\_TempE\_8 (18) = ND\_HTS\_175\_325\_PT6  
Alias Therm\_TempE\_8 (19) = ND\_HTS\_175\_325\_PT7  
Alias Therm\_TempE\_8 (20) = ND\_HTS\_175\_325\_PT8  
Alias Therm\_TempE\_8 (21) = ND\_HTS\_175\_325\_PT9

Alias Therm\_TempE\_8 (22) = ND\_HTS\_175\_335\_PT1  
Alias Therm\_TempE\_8 (23) = ND\_HTS\_175\_335\_PT2  
Alias Therm\_TempE\_8 (24) = ND\_HTS\_175\_335\_PT3  
Alias Therm\_TempE\_8 (25) = ND\_HTS\_175\_335\_PT4  
Alias Therm\_TempE\_8 (26) = ND\_HTS\_175\_335\_PT5  
Alias Therm\_TempE\_8 (27) = ND\_HTS\_175\_335\_PT6  
Alias Therm\_TempE\_8 (28) = ND\_HTS\_175\_335\_PT7  
Alias Therm\_TempE\_8 (29) = ND\_HTS\_175\_335\_PT8

Alias Therm\_109 (1)= South\_31  
Alias Therm\_109 (2)= South\_32  
Alias Therm\_109 (3)= South\_33  
Alias Therm\_109 (4)= South\_34  
Alias Therm\_109 (5)= South\_35  
Alias Therm\_109 (6)= South\_36  
Alias Therm\_109 (7)= North\_1  
Alias Therm\_109 (8)= North\_2  
Alias Therm\_109 (9)= North\_3  
Alias Therm\_109 (10)= North\_4  
Alias Therm\_109 (11)= North\_5

Alias Therm\_109 (12)= North\_6

```
'=====
'- - - - - Units - - - - -
'=====
```

```
'=====
'- - - - - Declare Constants - - - - -
'=====
```

' Thermistor constants 3000Ohm @ 25C thermistor

Const ConstC0 = 0.0014051

Const ConstC1 = 0.0002369

Const ConstC2 = 0.0000001019

```
'=====
'- - - - - Data Tables - - - - -
'=====
```

'Define Data Tables

DataTable (StationStatus,1,-1)

DataInterval (0,6,Hr,10)

CardOut (0 ,-1000)

Minimum (1,batt\_volt,FP2,0,False)

Sample (1,PTemp,FP2)

EndTable

DataTable (Daily\_Samples,1,-1)

DataInterval (0,6,Hr,10)

CardOut (0, -1000)

Sample (11,ND\_VTS\_130\_KT\_PT1,FP2)

Sample (11,ND\_VTS\_130\_US\_PT1,FP2)

Sample (11,ND\_VTS\_130\_DS\_PT1,FP2)

Sample (10,ND\_HTS\_130\_288\_PT1,FP2)

Sample (8,ND\_HTS\_130\_310\_PT1,FP2)

Sample (8,ND\_HTS\_130\_335\_PT1,FP2)

Sample (11,ND\_VTS\_175\_KT\_PT1,FP2)

Sample (9,ND\_HTS\_175\_325\_PT1,FP2)

Sample (8,ND\_HTS\_175\_335\_PT1,FP2)

Sample (12,Therm\_109(),FP2)

EndTable

```
'=====
'- - - - - Main Program - - - - -
'=====
```

BeginProg

Scan (6,hr,0,0)' 4 times daily at midnight, 6AM, noon, 6 PM

PanelTemp (PTemp,\_60Hz)

Battery (batt\_volt)

If TimeInInterval(0,6,hr)

'Muxplexer in 4x16 mode

'Turn on all AM16/32B-XT muxplexers

```

PortSet (1,1)'Node D_6

Delay (0,150,msec)
PulsePort (2,10000)
'Multiplexer D_6
' measurement conversions for Multiplexer D_6
'Calculate resistance for 33 thermistors
For Index = 1 To 36
    BrHalf (Therm_mV_D_6(Index),3,mv2500C,1,Vx1,3,2500,True ,20000,_60Hz,1.0,0)
    Index=Index+2
    PulsePort (2,10000)
Next
PortSet (1,0)

'Multiplexer D_7
PortSet (3,1) 'Node D_7
Delay (0,150,msec)
PulsePort (4,10000)
For Index2 = 1 To 30
    BrHalf (Therm_mV_D_7(Index2),3,mv2500C,4,Vx1,3,2500,True ,20000,_60Hz,1.0,0)
    Index2=Index2+2
    PulsePort (4,10000)
Next
PortSet (3,0)

'Multiplexer E_8
PortSet (5,1) 'Node E_8
Delay (0,150,msec)
PulsePort (6,10000)
For Index3 = 1 To 30
    BrHalf (Therm_mV_E_8(Index3),3,mv2500C,7,Vx2,3,2500,True ,20000,_60Hz,1.0,0)
    Index3=Index3+2
    PulsePort (6,10000)
Next
PortSet (5,0)

'Multiplexer E_9 (109 thermistors)
PortSet (7,1) ' Node E_9
Delay (0,150,msec)
PulsePort (8,10000)
For Index4 = 1 To 12
    Therm109 (Therm_109 (Index4),1,10,Vx3,20000,_60Hz,1.0,0)
    PulsePort (8,10000)
Next
PortSet (7,0)

For Index = 1 To 35
    ' Calculate resistance using equation :  $R_t = 10000 \cdot (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
    Therm_ResD_6(Index) =  $10000 \cdot (1 - \text{Therm\_mV\_D\_6}(\text{Index})) / \text{Therm\_mV\_D\_6}(\text{Index})$ 
    If Therm_ResD_6(Index) > 1000000 OR Therm_ResD_6(Index) < 0 Then Therm_ResD_6(Index) = 0
    Therm_TempD_6(Index) =
     $1 / (\text{ConstC0} + \text{ConstC1} \cdot \text{LN}(\text{Therm\_ResD\_6}(\text{Index})) + \text{ConstC2} \cdot (\text{LN}(\text{Therm\_ResD\_6}(\text{Index}))^3)) - 273.15$ 
Next

' Measurement conversions for Multiplexer D_7

```

```

For Index2 = 1 To 29
    ' Calculate resistance using equation :  $R_t = 10000 \cdot (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
    Therm_ResD_7(Index2) = 10000*(1-Therm_mV_D_7(Index2))/Therm_mV_D_7(Index2)
    If Therm_ResD_7(Index2) > 1000000 OR Therm_ResD_7(Index2) < 0 Then
Therm_ResD_7(Index2) = 0
        Therm_TempD_7(Index2) =
1/(ConstC0+ConstC1*LN(Therm_ResD_7(Index2))+ConstC2*(LN(Therm_ResD_7(Index2))^3))-273.15
    Next

    ' Measurement conversions for Multiplexer E_8
    For Index3 = 1 To 29
        ' Calculate resistance using equation :  $R_t = 10000 \cdot (1 - \text{Therm\_mV}(n)) / \text{Therm\_mV}(n)$ 
        Therm_ResE_8(Index3) = 10000*(1-Therm_mV_E_8(Index3))/Therm_mV_E_8(Index3)
        If Therm_ResE_8(Index3) > 1000000 OR Therm_ResE_8(Index3) < 0 Then Therm_ResE_8(Index3)
= 0
            Therm_TempE_8(Index3) =
1/(ConstC0+ConstC1*LN(Therm_ResE_8(Index3))+ConstC2*(LN(Therm_ResE_8(Index3))^3))-273.15
    Next

    CallTable (Daily_Samples)
    CallTable (StationStatus)

EndIf
NextScan
EndProg

```