CS10-L CURRENT TRANSFORMER
INSTRUCTION MANUAL

REVISION: 8/01

Warranty and Assistance

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CAMPBELL SCIENTIFIC, INC.
RMA#_____
815 West 1800 North
Logan, Utah 84321-1784

CAMPBELL SCIENTIFIC, INC. does not accept collect calls.

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CS10-L Current Transformer

1. General Description

The CS10-L uses CR Magnetic's CR8459 Current Transformer to measure the approximate current over a range of 0 - 200 A. The CS10-L outputs a millivolt signal allowing it to be directly connected to the CR510, CR10X, or CR23X dataloggers. The CS10-L is recommended for measurements that do not require high accuracy.

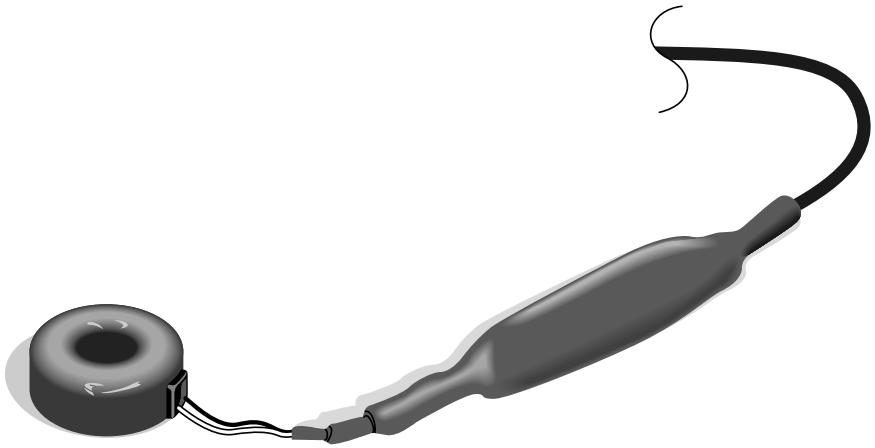

FIGURE 1. CS10-L Current Transformer

2. Specifications

Example Applications:

- Motor or generator load conditions
- Efficiency studies
- Intermittent fault detection
- Rough submetering

Manufacturer's Specifications

Frequency:	50 and 60 Hz
Insulation Resistance:	100 M ohm @ 500 VDC
High Potential:	2000 volts
Rated Current:	200 A
Storage Temperature:	-25°C to 70°C
Operating Temperature:	-25°C to 55°C
Case Material:	Polypropylene Resin
Construction:	Epoxy Encapsulated
Accuracy with 10 ohm burden max. (resistive):	typically ±10 percent of actual value

3. Installation

Mount the AC load wire through the hole of the CS510-L.

4. Wiring

The CS10-L uses a single-ended analog channel.

White ----------Single-Ended Channel
Black----------AG

5. Measurement Instruction

The CS10-L uses a P1 instruction.

NOTE The example measurement instructions that follow do not store data to final storage. Additional instructions (typically P92, P77 and output processing instructions such as P70) are required to store data permanently.

5.1 Sample Program

Measures a single CS10-L Current Transformer directly connected to the SE 1 channel of the CR10X.

The multiplier in this program example is representative of one application. The multiplier can be changed to match calibrated measurements. You should use a multiplier that you have validated for your purposes.

The sample program implements a simplified version of the root mean square (RMS) calculation, represented by the following:

$$RMS = \sqrt{\frac{\sum_{i=1}^{25}\left(x_i - \bar{x}\right)}{25}}$$

```
;{CR10X}

*Table 1 Program
  01: 10.0          Execution Interval (seconds)

; Measure Amps

1: Do (P86)
  1:  1             Call Subroutine 1
```

```
2:  Running Average (P52)                    ; This smoothes out some variability
   1:   1              Reps
   2:   1              First Source Loc [AMP_1]
   3:   2              First Destination Loc [AMPavg_1]
   4:   5              Number of Values in Avg Window

;
; Data storage instructions could be placed here
;

*Table 2 Program
   02: 0.0000       Execution Interval (seconds)

*Table 3 Subroutines

1:  Beginning of Subroutine (P85)
   1:   1              Subroutine 1

      2:  Beginning of Loop (P87)
         1:   0              Delay
         2:   25             Loop Count

            3:  Volt(SE)(P1)
               1:                  Reps
               2:   15             2500 mV Fast Range
               3:   1              SE Chan
               4:   5 --           Loc [i_1  ]          ; Note this parameter is indexed
               5:   1.0            Mult
               6:   0              Offset

      4:  End(95)

      5:  Do (P86)                                     ; Calculate RMS of 25 values
         1:   2              Call Subroutine 2

      6:  Z=X*F (P37)
         1:   101            X Loc [ rms      ]
         2:   .195           F                        ; Specific to CS10-L current transformer
         3:   1              Z Loc [ AMP_1 ]

7:  End (P95)

8:  Beginning of Subroutine (P85)            ; Calculates RMS of values in Inlocs [i_1]
   1:   2              Subroutine 2          ; through [i_25]

      9:  Spatial Average (P51)              ; Calculate mean of 25 measurements
         1:   25             Swath
         2:   5              First Loc [ i_1      ]
         3:   4              Avg Loc [ avg      ]

      10:  Z=F (P30)
         1:   0.0            F
         2:   00             Exponent of 10
         10:  3              Z Loc [ rms      ]
```

```
    12:  Beginning of Loop (P87)              ; Subtract off the mean and add up the squares
      1:   0              Delay
      2:   25             Loop Count

        13:  Z=X-Y (P35)
          1:   5 --         X Loc [ i_1     ]
          2:   4            Y Loc [ avg     ]
          3:   5 --         Z Loc [ i_1     ]

        14:  Z=X*Y (P36)
          1:   5 --         X Loc [ i_1     ]
          2:   5 --         Y Loc [ i_1     ]
          3:   5 --         Z Loc [ i_1     ]

        15:  Z=X+Y (P33)
          1:   3            X Loc [ rms     ]
          2:   5 --         Y Loc [ i_1     ]
          3:   3            Z Loc [ rms     ]

    16:  End (P95)

    17:  Z=X*F (P37)                          ; Divide by 25
      1:   3              X Loc [ rms     ]
      2:   .04            F
      3:   3              Z Loc [ rms     ]

    18:  Z=SQRT(X) (P39)                      ; and calculate the square root
      1:   3              X Loc [ rms     ]
      2:   3              Z Loc [ rms     ]

19:  End (P95)
```

5.2 Sample Program

Program using the CR10X and an AM16/32 or AM416 multiplexer to read eight CS10-L current transformers.

```
; Activate AM416

;{CR10X}

*Table 1 Program
  01:  10.0          Execution Interval (seconds)

1:  Do (P86)
  1:   41            Set Port 1 High

; Begin Measurement Loop

2:  Beginning of Loop (P87)
  1:   0             Delay
  2:   8             Loop Count
```

```
; Pulse Clock

    3:  Do (P86)
      1:   72            Pulse Port 2

; Delay

    4:  Excitation with Delay (P22)
      1:   1             Ex Channel
      2:   0             Delay W/Ex (units = 0.01 sec)
      3:   1             Delay After Ex (units = 0.01 sec)
      4:   0             mV Excitation

; Measure AMPS

    5:  Do (P86)
      1:   1             Call Subroutine 1

    6:  Z=X*F (P37)
      1:   19            X Loc [ rms      ]
      2:   .195          F
      3:   1 --          Z Loc [ AMP_1   ]

7:  End (P95)

8:  Running Average (P52)
  1:   8               Reps
  2:   1               First Source Loc [AMP_1]
  3:   9               First Destination Loc [AMPavg_1]
  4:   5               Number of Values in Avg Window

; Deactivate AM416

9:  Do (P86)
  1:   51              Set Port  Low

*Table 3 Subroutines

1:  Beginning of Subroutine (P85)
  1:   1               Subroutine 1

    2: Beginning of Loop (P87)
      1:   0             Delay
      2:   25            Loop Count

        3:  Volt(SE)(P1)
          1:   1             Reps
          2:   15            2500 mV Fast Range
          3:   1             SE Channel
          4:   21 --         Loc[i_1  ]
          5:   1.0           Mult
          6:   0.0           Offset

    4:  End(P95)
```

```
    5:  Do (P86)
      1:   2              Call Subroutine 2

6:  End (P95)

7:  Beginning of Subroutine (P85)
  1:   2              Subroutine 2

    8:  Spatial Average (P51)
      1:   25             Swath
      2:   21             First Loc [ i_1      ]
      3:   20             Avg Loc [ avg      ]

    9:  Z=F (P30)
      1:   0.0            F
      2:   00             Exponent of 10
      10:  19             Z Loc [ rms      ]

    10:  Beginning of Loop (P87)
      1:   0              Delay
      2:   25             Loop Count

        11:  Z=X-Y (P35)
          1:   21 --          X Loc [ i_1      ]
          2:   20             Y Loc [ avg      ]
          3:   21 --          Z Loc [ i_1      ]

        12:  Z=X*Y (P36)
          1:   21 --          X Loc [ i_1      ]
          2:   21 --          Y Loc [ i_1      ]
          3:   21 --          Z Loc [ i_1      ]

        13:  Z=X+Y (P33)
          1:   19             X Loc [ rms      ]
          2:   21 --          Y Loc [ i_1      ]
          3:   19             Z Loc [ rms      ]

    14:  End (P95)

    17:  Z=X*F (P37)
      1:   19             X Loc [ rms      ]
      2:   .04            F
      3:   19             Z Loc [ rms      ]

    18:  Z=SQRT(X) (P39)
      1:   19             X Loc [ rms      ]
      2:   19             Z Loc [ rms      ]

19:  End (P95)
```