LCI

```
*  Utility Relay Co  *
*  *      Local      *  *
*  Communications  *
*  *   Interface    *  *
```

SCAN   VOLTS   POWER   SET POINTS   ▲   CONT.

HOLD   LAST TRIP   LOG   FUNC.   ▼   ENTER

LCI

LOCAL COMMUNICATIONS
INTERFACE

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INSTRUCTION MANUAL

*Substation Monitoring
and Network Connectivity*

URC Utility Relay Company

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Manual Revision 2.1

1.0   Introduction

The *Local Communications Interface (LCI)* is a network enabled display station for the AC-PRO and ZERO-Hertz communicating trip units from Utility Relay Company. The LCI continuously monitors up to 32 trip units connected thru the RS-485 ModBus® interface. During normal operations the LCI provides collected information to both its LCD display and its main web page.

Trip unit information is displayed on the LCI's 4x20 character LCD. During normal operation all attached trip units are sequentially queried (or scanned) at a rate of about one unit every three seconds. Normally the current measured by each trip unit is displayed, however, detailed trip unit information can be easily accessed thru the front panel buttons.

In addition, the LCI has Ethernet support over port 502 (ModBus®-TCP) where the LCI functions as an Ethernet to RS-485 interface to the remote trip units. TCP operations are independent of the normal LCI monitoring process and provide direct access to all trip unit registers. This feature requires the usage of a third-party Human-Machine Interface system (HMI) such as WonderWare®, InTouch® by Intellution®, PEGASYS® by Power Measurements LTD® (PML), PowerLogic® by Square D®, CIMPLICITY® by General Electric® (GE), and others.

Please refer to External Connectors in Section 11.0 for the location of the RS-485 Terminal, Ethernet Jack, Power On/Off Switch, and Power LED.

Please note: The LCI <u>front panel</u> and <u>web page</u> operations that the LCI performs does NOT affect the protection features in the trip units. The LCI is a monitoring device only and neither enables nor disables protection features of the AC-PRO or ZERO-Hertz trip units. Deleting a trip unit only removes it from the LCI Scan List and does nothing to the trip units.

2.0   Setup

The user communicates with the LCI via an Ethernet connection – either over a formal network or to a stand-alone computer (usually a laptop).

2.1   Network Setup

If there is a formal network connected to the LCI, the user must coordinate with the system administrator to determine the following:
- ?? The IP Address assignment for the LCI. The IP is configurable using the LCI front panel.
- ?? The net mask assignment for the LCI. This is also configurable using the LCI front panel.
- ?? Proper configuration of the user's Internet browser used to access the LCI web pages.

The physical connection to the network is done using a CAT-5 **<u>straight-cable</u>** which plugs into the RJ-45 Ethernet jack on the LCI's computer board and into a convenient network HUB.

2.2   Stand-Alone (laptop) Setup

If the LCI is to be a stand-alone unit then the following should be confirmed:
- ?? The default IP Address for the LCI is: **10.1.1.150**
- ?? The default net mask for the LCI is: **255.255.255.0**
- ?? Your Internet browser should **not** be connected via a proxy. Also, in your Network Properties, you must **not** use DHCP (Dynamic Host Configuration Protocol), you must assign an IP address and net mask to your local computer.

The physical connection to the laptop is done using a CAT-5 **<u>crossover cable</u>** which plugs into the RJ-45 Ethernet jack on the LCI's computer board and the NIC (network interface card) on the laptop.

2.3   Testing the Ethernet Connection

You should now be able to *ping* the LCI from a Command Prompt (or DOS Prompt) window. Using the above *Stand-Alone (laptop)* example, you should be able to type: "ping 10.1.1.150" and immediately see: "Reply from 10.1.1.150…" and further data. If you do not get a reply, use the LCI **FUNC** key and scroll to the "Examine IP" screen to confirm or change the IP and net mask settings.

3.0   Front Panel Key Definitions

The front panel LCD display and keypad allow examination and monitoring of all main values of Utility Relay trip units. The keypad and the key definitions are:

SCAN   **SCAN** is the normal operational mode for the LCI. This button may be pressed at any time. When scanning, the current for each trip unit is displayed for about 3 seconds and then the LCI cycles to the next unit. The LCI continues in scan mode as long as there is either front-panel button usage or its web page is accessed, otherwise it resorts back to Idle mode in about 15 minutes.

VOLTS   This button displays the voltage for the current scan-address trip unit for 30 seconds (AC-PRO only) and then reverts back to the **SCAN** mode. The displayed voltage is periodically refreshed.

POWER   This button displays the power for the current scan-address trip unit for 30 seconds (AC-PRO only) and then reverts back to the **SCAN** mode. The power display is periodically refreshed.

SET POINTS   This button displays various settings for the current scan-address trip unit for 30 seconds and then reverts back to the **SCAN** mode. The display is refreshed about every 5 seconds.

? ?   The **UP** and **DOWN ARROWS** are generic in nature, their usages include: fast access to any trip unit when in scan mode, fast screen access within any register display screen (e.g. **SET POINTS**), menu navigation (e.g. **FUNC**), and editing (e.g. Examine IP within the **FUNC** menu).

CONT   Press the **CONT** button, then use the **UP ARROW** and **DOWN ARROW** keys to adjust the contrast according to local lighting conditions. While adjusting the contrast the display is not refreshed. After approximately 3 seconds of no input the previously active mode is resumed.

HOLD   This button will "hold" the current scan-address, the trip unit displayed when the **HOLD** button is pressed is periodically rescanned and any updates displayed. Press the **SCAN** key to resume normal operation. Hold will timeout in 10 minutes and resume normal scan mode operation.

LAST TRIP   This button will show the last trip information for the current scan address for 30 seconds before reverting to the **SCAN** mode.

LOG   This button will display the various trip counts for each trip unit type for 30 seconds before reverting to the **SCAN** mode.

FUNC   This button will show a list of functions that are defined in the LCI. After pushing **FUNC** the user may scroll through the list of functions using the **DOWN ARROW** key. The user may accept any function to execute by pushing the **UP ARROW** key or finish the entire list and execute none of them.

ENTER   A generic key with various usages such as defining/changing the IP address.

4.0   LCI Operating States & Features

4.1   The Scan List

After the LCI initializes it enters the Idle Mode and prompts the user to press the SCAN key to monitor attached trip units. The first time the SCAN key is pressed it will search for units and add them to the scanlist. This list contains the unit address, type (AC-PRO or ZERO Hertz), serial number, substation name and breaker name. The assigned substation and breaker names can be changed either through the front panel FUNC key or the Edit Trip Unit web page. Once a unit is added to the scan list it can be removed by either the FUNC key operation: Add/Del Trip Units or Decommission LCI.

Scan List Summary and Defaults:
Substation Name – Substation Alpha (default, can be changed)
Breaker Name - Breaker XX (where XX is the MODBUS address – default, can be changed)
Product Name and firmware version - AC-PRO or ZERO-Hertz
Serial Number
Unit Comaddr - set automatically to correct MODBUS address

4.2   Auto Discovery

The LCI automatically detects and identifies any communicating URC Trip Units attached and will add them to the scan list. The LCI will examine one unused MODBUS address every 30 seconds to see if a new trip unit is present. After about 15 minutes it will have examined every unused address (from 1 to 32). This process continues as long as the LCI is in Scan mode so any new Trip Units that are added after the LCI is in service will be discovered automatically and added to the SCAN list. To immediately scan for new units use the FUNC key operation Add/Del Trip Units, this will scan all unused addresses for trip units.

4.3   Idle Mode

This is the LCI default state where it functions only as an Ethernet to RS-485 converter for third-party HMI (Human-Machine Interface) type applications.

4.4   Scan Mode

Performs sequential reads of all trip units in the LCI scan list providing updated trip unit information on both the front-panel display and web page. Scan mode can be entered by either the front-panel SCAN button or by a web page access to the LCI. The LCI continues in scan mode as long as there is either front-panel button usage or its web page is accessed, otherwise it resorts back to Idle mode in about 15 minutes.

Normally the LCI should not be in Scan mode when functioning as an Ethernet to RS-485 converter as the RS-485 network traffic for TCP access is severely reduced by Scan mode accesses. Nevertheless, to help with bandwidth restrictions, the LCI scans at a reduced rate whenever (resource competing) TCP traffic is detected.

4.5   Offline

Whenever a scanned trip unit cannot be accessed, both the front-panel and web page refer to the unit as being *offline*. There can be various reasons for this condition with the most common being either RS-485 network problems or no (or intermittent) power to the trip unit. If a trip unit is removed from service, it can be removed from the scan list by the FUNC key Add/Delete Trip Units.

5.0   Front Panel Displays

5.1   SCAN Screen

This function loops through every breaker that is defined and shows the current on each breaker. A typical display for the AC-PRO and the ZERO-Hertz would appear as follows:

AC-PRO Display:

```
BRK XXXXXXXXXXXXXXXX
A=XXXXA        B=XXXXA
C=XXXXA
GF=XXXXA      UB=XX%
```

Phase A, B or C current will display LOW whenever the current is below 10% of the CT rating. GF(Ground Fault) will only appear whenever its value is greater than or equal to 10% of the CT rating and GF is enabled in the trip unit.

ZERO-Hertz Display:

```
BRK XXXXXXXXXXXXXXX
Current=XXXXXA
Direction=Forward

```

5.2   VOLTS Screen

AC-PRO Display:

```
BRK XXXXXXXXXXXXXXXX
VAB=XXXX      VAG=XXXX
VBC=XXXX      VBG=XXXX
VCA=XXXX      VCG=XXXX
```

This displays the Voltage for 30 seconds. After that time the display will revert to the **SCAN** mode.

5.3   POWER Screens

Displays power readings, two screens are displayed alternately every three seconds for approximately 30 seconds. After that time the display will revert to the **SCAN** mode.

AC-PRO Display:

```
BRK XXXXXXXXXXXXXXX          BRK XXXXXXXXXXXXXXX
A KW=XXXXX KVA=XXXXX
B KW=XXXXX KVA=XXXXX          KWHRS=XXXXX.X
C KW=XXXXX KVA=XXXXX
```

5.4   SET POINTS Screens

The Set Points display will show many of the parameters that were set when the trip unit was commissioned. Use the SET POINTS or arrow keys to navigate, after 30 seconds of no key presses the display will revert to the **SCAN** mode. Screens will automatically advance once every 3 seconds.

AC-PRO Displays:

```
BRK XXXXXXXXXXXXXXXX
SUB XXXXXXXXXXXXXXX
AC-PRO SN    XXXXXXX
CT RATING     XXXXA
```

```
BRK XXXXXXXXXXXXXXX

LT PICK-UP     XXXXA
LT DELAY    XX.XSec
```

```
BRK XXXXXXXXXXXXXXXX          - OR -          BRK XXXXXXXXXXXXXXX
ST PICK-UP     XXXXA
ST DELAY      .XXSec                          ST PICK-UP      OFF
ST I SQ T       XXX
```

```
BRK XXXXXXXXXXXXXXX           - OR -          BRK XXXXXXXXXXXXXXX

I PICK-UP      XXXXA                          I PICK-UP       OFF
```

```
BRK XXXXXXXXXXXXXXX           - OR -          BRK XXXXXXXXXXXXXXX
GF PICK-UP     XXXXA
GF DELAY      .XXSec                          GF PICK-UP      OFF
GF I SQ T       XXX
```

```
BRK XXXXXXXXXXXXXXX           - OR -          BRK XXXXXXXXXXXXXXX

U/B PICK-UP     XX%
U/B DELAY     XXSec                           U/B PICK-UP     OFF
```

```
BRK XXXXXXXXXXXXXXX           - OR -          BRK XXXXXXXXXXXXXXX

COM ADDRESS      XX                           GF QT PICK-UP  XXXXA          AC-PRO QT?  only
REPLY DELAY    XXMS                           I QT PICK-UP   XXXXA
```

                                             - AND/OR -

```
                                             BRK XXXXXXXXXXXXXXX

                                             COM ADDRESS      XX          Ver 5.00 and later
                                             REPLY DELAY    XXMS
```

ZERO-Hertz Displays:

```
BRK XXXXXXXXXXXXXXXX
SUB XXXXXXXXXXXXXXXX
ZERO-HZ SN   XXXXXXX
TRANSDUCER    XXXXXA
```

```
BRK XXXXXXXXXXXXXXXX
LT PICK-UP     XXXXA
LT DELAY    XX.XSec
LT THERMAL      OFF
```

```
BRK XXXXXXXXXXXXXXXX
ST PICK-UP     XXXXA
ST DELAY     .XXSec
ST I SQ T       OFF
```
- OR -
```
BRK XXXXXXXXXXXXXXX
ST PICK-UP      OFF
```

```
BRK XXXXXXXXXXXXXXX
I PICK-UP     XXXXXA
```
- OR -
```
BRK XXXXXXXXXXXXXXX
I PICK-UP       OFF
```

```
BRK XXXXXXXXXXXXXXX
GF PICK-UP     XXXXA
GF DELAY     .XXSec
GF I SQ T       OFF
```
- OR -
```
BRK XXXXXXXXXXXXXXX
GF PICK-UP      OFF
```

```
BRK XXXXXXXXXXXXXXX
RC PICK-UP     XXXXA
RC DELAY     .XXSec
RC I SQ T       OFF
```
- OR -
```
BRK XXXXXXXXXXXXXXX
RC PICK-UP      OFF
```

```
BRK XXXXXXXXXXXXXXX
ALARM SETTINGS:
COM  OFF   UV OL OFF
TRIP OFF    ERR OFF
```

```
BRK XXXXXXXXXXXXXXX
COM ADDRESS      XX
IDLE LINE      OFF
```

5.5   LAST TRIP Screens

Displays data from the last trip, two screens are displayed alternately every three seconds for approximately 30 seconds. After that time the display will revert to the **SCAN** mode.

AC-PRO Displays:

```
BRK XXXXXXXXXXXXXXX        BRK XXXXXXXXXXXXXXX
LAST TRIP:      TYPE
A=XXXXA      B=XXXXA        GF=XXXXA
C=XXXXA
```

TYPE is LT, ST, I, GF, U/B, FORCED, I QT[?], GF QT[?], or None.

ZERO-Hertz Displays:

```
BRK XXXXXXXXXXXXXXX        BRK XXXXXXXXXXXXXXX
LAST TRIP:      TYPE
Current=XXXXXA             GF=XXXXXA
Direction=Reverse
```

TYPE is LT, ST, I, RC, UV OL, FORCED, or None.

5.6   LOG Screens

Displays various trip counts for each trip unit type. Two screens are displayed alternately every three seconds for approximately 30 seconds. After that time the display will revert to the **SCAN** mode.

AC-PRO Displays:

```
BRK XXXXXXXXXXXXXXX    I TRIPS          XX    I QT TRIPS        XX
SUB XXXXXXXXXXXXXXX    GF TRIPS         XX    GF QT TRIPS       XX
LT TRIPS        XX    U/B TRIPS        XX
ST TRIPS        XX    FORCED TRIPS     XX
```

```
                                            AC-PRO QT? only
```

ZERO-Hertz Displays:

```
BRK XXXXXXXXXXXXXXX    I XX      GF XX
SUB XXXXXXXXXXXXXXX    RC TRIPS         XX
LT TRIPS        XX    UV OL TRIPS      XX
ST TRIPS        XX    FORCED TRIPS     XX
```

---

* LAST TRIP types I QT and GF QT are supported in AC-PRO QT? only.

5.7   FUNC Screens

This allows access to other screens in the LCI. These provide more information about trip units and allow the user to display and change settings related to the LCI itself.

Pressing FUNC will display:

```
?=Yes            ?=No
Show Alarm Codes?
```

Pressing the **UP ARROW** will show the alarm screen for that breaker. Thereafter, use the **UP/DOWN ARROW** to view other breakers or SCAN to exit.

```
BRK Breaker XX

      no alarms
```

```
BRK Breaker XX
   ACTIVE ALARMS:
alarm type(s)
```

Alarm types are TRIP, OL, MEM, BATT, ACTUATOR, (and for ZERO-Hertz only) A/D, and TRANSDUCER.

The alarm screen is displayed for approximately 30 seconds and is periodically refreshed.

Pressing the **DOWN ARROW** will advance to the next function:

```
?=Yes            ?=No
Examine IP?
```

Pressing the **UP ARROW** allows the user to view/change the IP address and net mask of the LCI. Pressing the **UP ARROW** allows the user to view/change the IP address and net mask of the LCI.

```
IP   10.1.1.150
MASK 255.255.255.0
?=Yes            ?=No
Enter new IP data?
```

Pressing **DOWN ARROW** will advance to the next function:

```
?=Yes            ?=No
Enter IDLE Mode?
```

Pressing **UP ARROW** will return the LCI to the IDLE state. Trip units will not be monitored in the Idle Mode.

```
   Idle Mode

Press SCAN key to
monitor trip units
```

Pressing **DOWN ARROW** will advance to the next function:

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```
┌──────────────────────────────┐
│                              │
│                              │
│ ?=Yes             ?=No       │
│ Show Release?                │
└──────────────────────────────┘
```

Pressing **UP ARROW** shows the revision of firmware running on the LCI.

```
┌──────────────────────────────┐
│ V5.30  14 Dec 2005           │
│                              │
│ ?=Yes             ?=No       │
│ Yes or No to resume          │
└──────────────────────────────┘
```

Pressing **DOWN ARROW** will advance to the next function:

```
┌──────────────────────────────┐
│                              │
│                              │
│ ?=Yes             ?=No       │
│ Add/Del Trip Units?          │
└──────────────────────────────┘
```

Pressing **UP ARROW** advances to the find new units screen. Then, pressing the down arrow (**?**=No) will advance to the remove trip units screen.

```
┌──────────────────────────────┐
│ Find new Trip Units?         │
│                              │
│ ?=Yes             ?=No       │
└──────────────────────────────┘
```

Find new Trip Units: Auto-searches for any units not in the scan list.

Remove Trip Units: Allows one or more units to be removed from the scan list, user is prompted before removal.

```
┌──────────────────────────────┐
│ Remove Trip Unit(s)?         │
│                              │
│ ?=Yes             ?=No       │
└──────────────────────────────┘
```

Note: **Units can be reinserted using the ADD/DEL Trip Units function however they will not be reinserted automatically via the Auto Discovery feature. Refer to the Auto Discovery section for further information about this feature.**

Pressing **DOWN ARROW** will advance to the next function:

```
┌──────────────────────────────┐
│                              │
│                              │
│ ?=Yes             ?=No       │
│ Decommission LCI?            │
└──────────────────────────────┘
```

Pressing **UP ARROW** will return the LCI to its factory default state. This will delete all defined Trip Units and require reentry of the IP address and net mask.

```
┌──────────────────────────────┐
│        About to              │
│    Decommission LCI          │
│ ?=Yes             ?=No       │
│ Are you sure?                │
└──────────────────────────────┘
```

.

6.0   LAN Access

Your LAN configuration should resemble that of Figure 1.

Depending on the complexity and number of units there are two ways to access trip unit data via a LAN:

1) Simply access the LCI main web page for or;

2) Utilize software drivers such as Kepware TCP-Modbus to link into URC's defined Excel spreadsheets or use a more detailed diagrammatical interfaces such as WonderWare.

Figure 1 - LCI LAN Configuration

Breakers with URC communicating trip units

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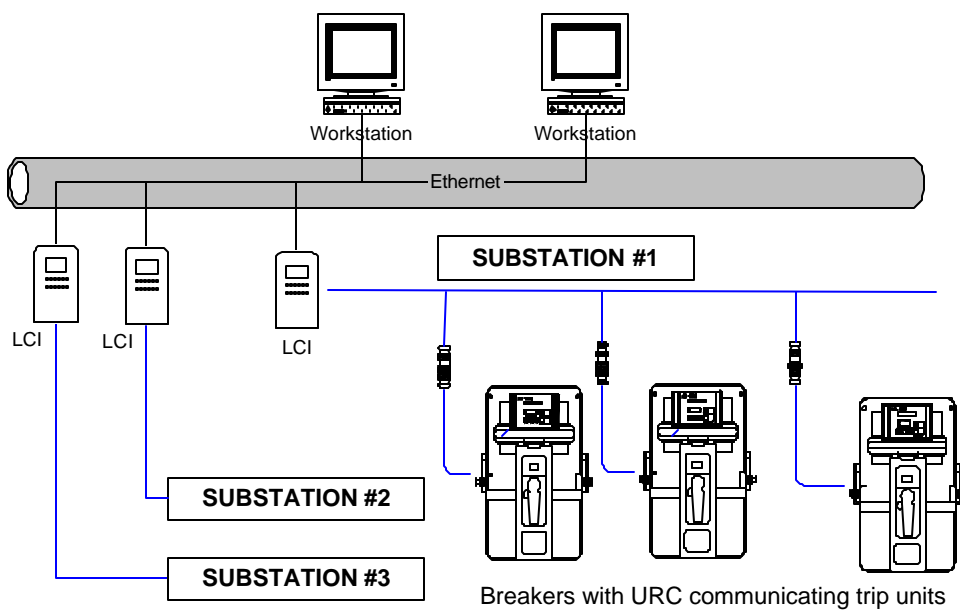
## 7.0   Main Web Page

7.1   Main Web Page Example

The screen shot below shows an example of the LCI main web page.

There are seven AC-PRO trip units, six with normal alarm conditions and one with an abnormal status.

Notice that "No alarms" is the default and the alarms area is empty. When there is an alarm it appears in**red** for emphasis.

Note: Because this is a simulation, Ground Fault currents were included even though this would be an abnormal condition in reality.

Figure 2 – Main web page showing an alarm condition on Breaker 18
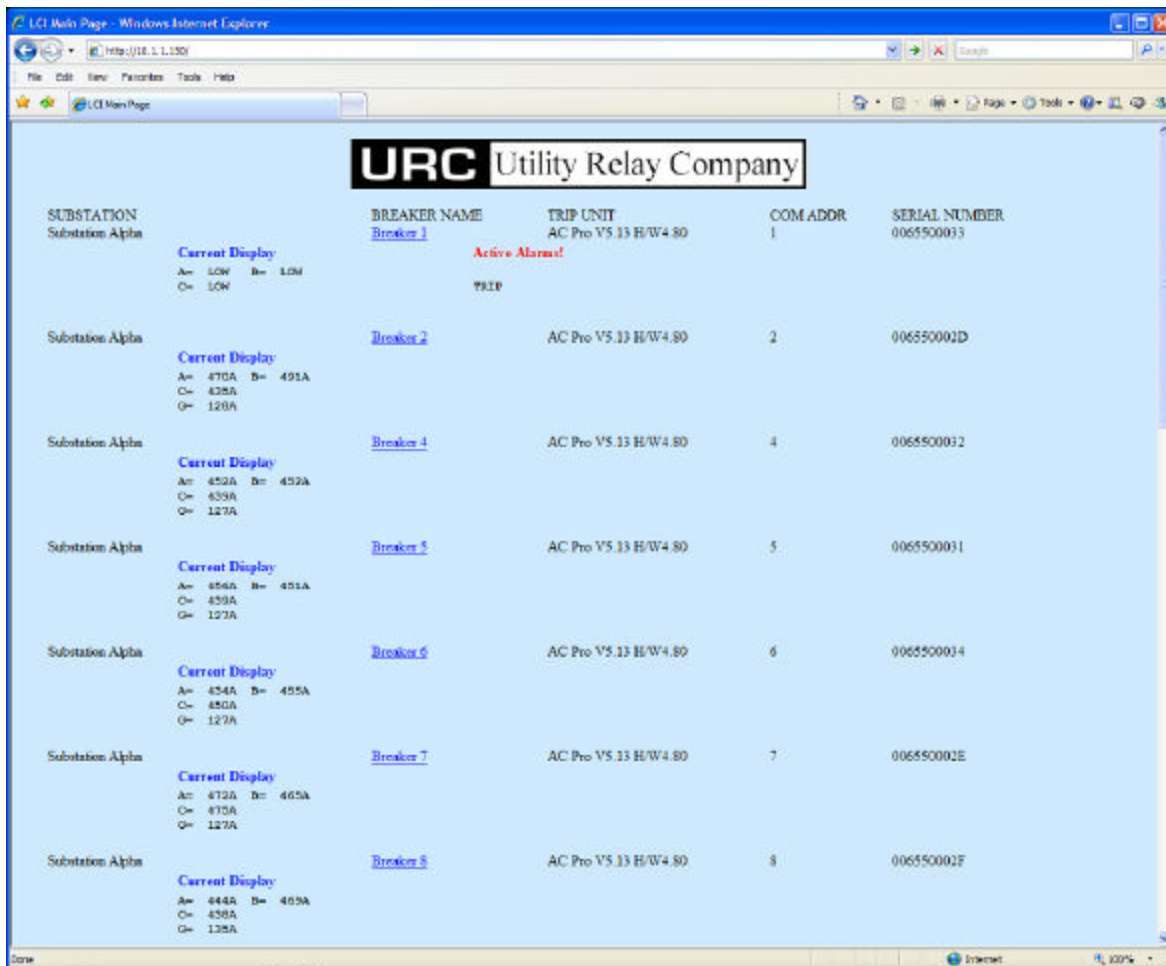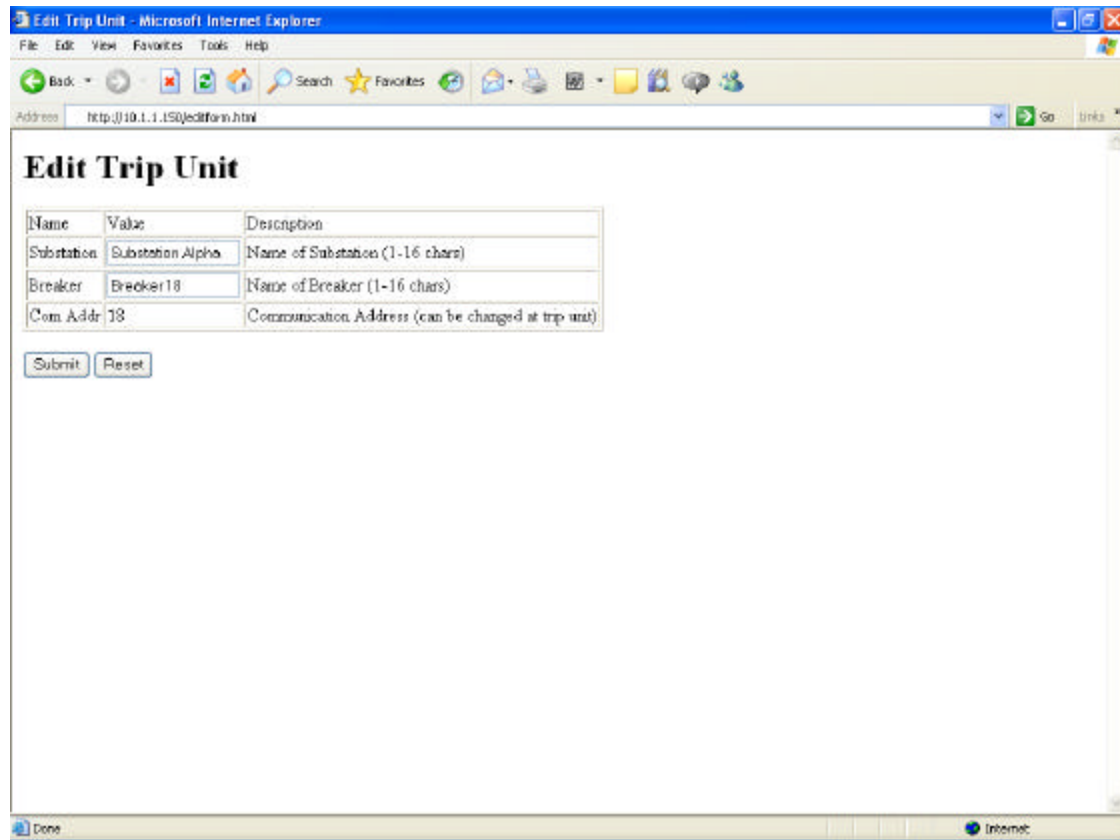
7.2   Edit Trip Unit Web Page

This screen shot shows an example of the LCI Edit Trip Unit web page.

This page allows the user to change the Substation and Breaker text. Note that each name is limited to 16 alpha-numeric characters.

**Figure 3 – Edit Trip Unit web page**

8.0   Advanced LAN Data Displays

Utility Relay Company's communications products are ModBus® compatible so that they can be used with most of the popular graphical HMI (Human-Machine Interface) systems which offer integrated Modbus® drivers. Those systems include WonderWare®, InTouch® by Intellution®, PEGASYS® by Power Measurements LTD® (PML), PowerLogic® by Square D®, CIMPLICITY® by General Electric® (GE), and others.

Since Utility Relay Company supports the industry standard open-architecture ModBus® protocol, it is easy to incorporate URC products into existing HMI systems. Figure 4 shows a sample WonderWare? One Line Diagram.

Figure 4 – WonderWare? One Line Diagram
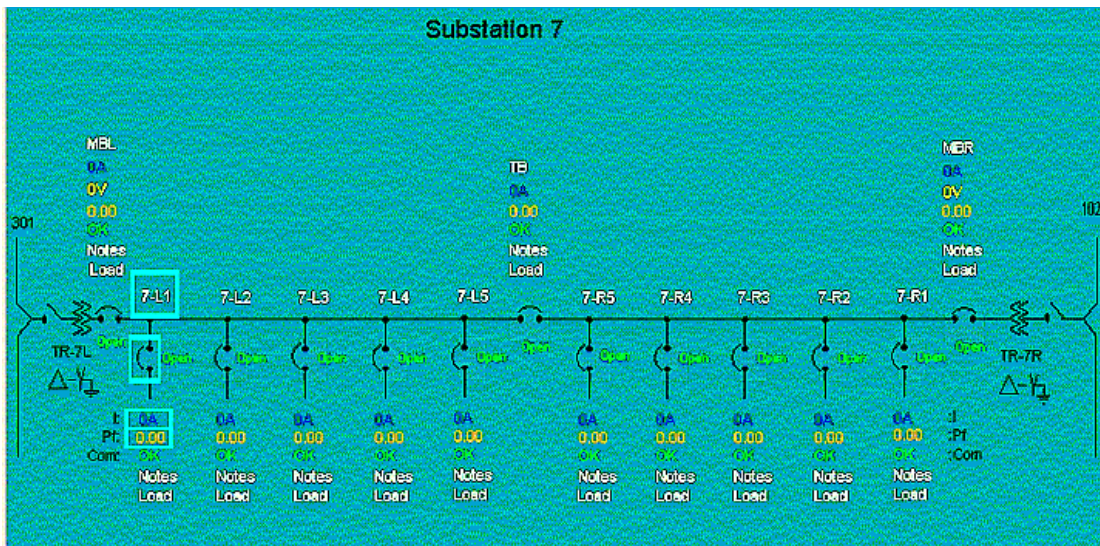
9.0   Specifications

Installing the LCI

The LCI is housed in a NEMA 4X fiberglass enclosure. The outline dimensions are shown in Figure 5, Section 10.0. Four fiberglass mounting feet are included which can be attached horizontally or vertically as shown.

Two 3/4 inch conduit hubs are included to provide cable entry into the LCI enclosure.

Temperature & Humidity

Operating
Temperature: 0°C to 50°C

Humidity: 5 to 95%, non-condensing

External Connections

The LCI external connections are:

Input power: 120, 208 or 240 volt, 50/60 Hertz; 0.25 amp maximum
                 Input fuse, 3A, 250V, 5X20mm

RS-485:   Shielded twisted pair to AC-PRO or ZERO-Hertz trip units, see Figure 6, Section 11.0.

Ethernet: RJ45 Ethernet jack

Do not run the power wiring in the same conduit as the Ethernet or RS-485 communication cables.

Ethernet

10BaseT RJ-45

10/100 Mbps

RS-485

Modbus compatible

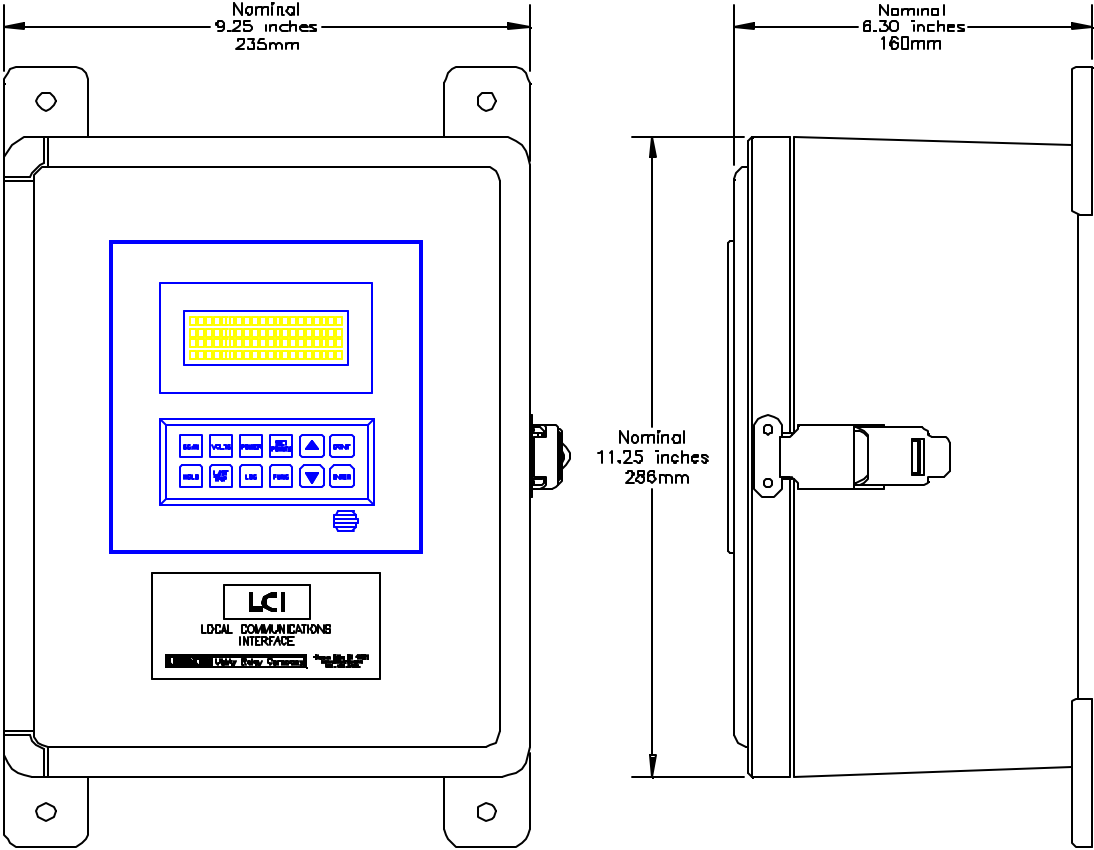9600 baud, 8 data bits, no parity, 1 stop bit (9600, 8/N/1)

Recommended cable Belden 9463

Max cable length 4000 feet

Max load 32 remote trip units and one LCI

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10.0   Outline Dimensions

Figure 5 - Outline Dimensions

11.0   External Connections

Figure 6 - External Connections

RS485 Twisted pair communication cable
to AC-PRO and ZERO-Hertz trip units.

Use Beldon 9463 (Blue jacket),
Beldon 9841 (Grey jacket) or equal.

IMPORTANT:
Maintain proper polarity,
Blue wire is "+".

LED

Serial Number

RJ45 Ethernet Jack

NOTE:
Do not run communication cables
in same conduit with power wiring.

Power
Switch

Power Input
120, 208, 240 volt, 50/60Hz
0.25 amp maximum