RODE – Recloser Interface Task Force Meeting Minutes

April 23, 2018 – Disney Contemporary Resort, Orlando, Florida

Chair: Mark Feltis

Meeting Minutes

1. **Call to Order** Mark Feltis

   Order was called

2. **Introduction of Members and Guests** Mark Feltis

   Introductions were made.

3. **Patents concerns reminder** Mark Feltis

4. **Attendance** Mark Feltis

   Routed an attendance sheet; 17 attendees total (See Annex)

5. **Review Minutes** Mark Feltis

   Minutes of past Task Force meeting (October 11, 2017) were reviewed.

   Motion to accept: Francois Soulard; Second: Anil Dhawan

6. **Review some items in Mark Feltis' March 30, 2018 email** Mark Feltis

   From the October 11, 2017 minutes, mention was made to review the following standards:

   - IEEE Std C37.11-2014 Electrical Control for AC High-Voltage (>1000V) Circuit Breakers
   - IEEE 789-2013 Standard Performance Requirements for Communications and Control Cables for Application in High-Voltage Environments

   Mark reviewed them and discussed them in a March 30, 2018 email he sent out to the group (included in presentation items in Annex).

   Mark thought C37.11 didn't have direct application to the work of the group, but the overall idea it presented (standard interface for circuit breakers) is like the idea that a possible future working group (derived from this task force) would pursue (i.e., a standard interface between the control units and switching device of an automatic circuit recloser).

   Mark thought that the 789 standard could have application for our group in that it had details that appeared to relate to the various circuits that come through a recloser interface.

7. **Revised Scope**

Mark Feltis offered the following revised scope, per the October 11, 2017 minutes, where mention was made to have it encompass power system voltages and input power.

IEEE RODE Task Force on Automatic Circuit Recloser Interfaces

> This task force is set up to consider interfaces between the control unit and switching device of an automatic circuit recloser (three-phase units, including those with single-phase operation capability). It will look at existing, in-service interfaces and document their signals, for ease of comparison and to understand "where we have been" as an industry. Interface considerations are not necessarily constrained to just one connector/entrance on the control unit, nor to just signals originating within the switching device (e.g., voltage sensors can be installed without the switching device). The total interface can include traditional signals (trip/close, power system currents, and switching device status), power system voltages (traditional secondary voltages or low-level sensor output), and input power to the control unit. Communication interfaces will not be considered. The task force especially seeks the participation of electric utility engineers and their experience/thoughts on such interfaces. The task force will produce a report of its findings and also summarize what future interface work should be done, if any.

Mention was made of adding single-phase recloser interfaces to the discussion – a separate table in a future standard.
Include all cables and connectors (standard control cable, input power, and power system voltages) that make an interoperable interface – Brad Lewis
Mark encouraged members to email any input they may have concerning the scope.

Tim Royster questioned the overall purpose of this task force since reclosers and controls are normally purchased together.
Craig Thompson referred to customers that buy reclosers and controls separately and also retrofit.
Brad Lewis supported Craig's claim, stating that some manufacturers make reclosers and controls … some just make controls. Having an interface standard simplifies design for manufacturer and purchasing for utilities.
Anil also suggested the value of having such an interface standard.
Tim suggested that possibly a future standard would have a set of interfaces that are covered.

8. Connector discussion

Mark acknowledged receipt of connector information from Ian Rokser (14, 19, 26, and 37 pin interfaces) and Kate Cummings (10, 14, 19, 32, and 42 pin interfaces).

Ian Rokser discussed "scoop proof" connectors. Which connectors are scoop proof? 14-pin, 19-pin and 26-pin are not; the Eaton 37 pin is. Craig said "scoop proof-ness" should be one of many evaluation criteria for a future interface standard.
Francois: Another criteria is for no live power on male pins … overall, don't have easily accessible/easily touched power or otherwise energized pins (e.g., current transformer secondary). Always start with safety when considering connector application. These concerns would also apply to a connector for battery power.

Francois suggests separate connectors for power, communications, and control to allow for proper orientation.
Anil wants criteria to be easy to install and connect and must be robust against water intrusion.
Brad and Francois both agreed that water intrusion has been an issue with the MS5015 style connectors.
Brad mentioned that AEP has used a “site ready” approach with recloser installations … the control cable is already correctly attached to the enclosure before it is shipped out to the site for full installation. This was a solution to the problem of the control cable not being correctly connected up to the enclosure in the field.
Francois: Also need to consider protection of the solder cups on the connector.
Tim: need to protect back of connectors on cables as well because a nicked cable can result in water on back of connector – Anil shared similar issue.
Francois shared that greasing the connector threads has resulted in a much better experience with getting connectors fully seated, removed and re-seated. Says linemen have damaged connector shells trying to remove them in some cases.

9. “69” contacts/”yellow handle” discussion

Refer also to presentation items in Annex, near the end. Mark Feltis wanted to confirm the appropriate references to contacts (often referred to as “69” contacts) that follow the operation of the “yellow handle” on reclosers. “69” is in reference to device number 69 which is a permissive control device and is defined in IEEE C37.2. The “yellow handle” is manually operated. A brief review of traditional “yellow handle” operation:

> When the recloser is closed, the “yellow handle” is in the “up” or “closed” position. With the “yellow handle” in the “up” or “closed” position, the recloser can be tripped open and closed via the control, because the “69” contact that supervises the close circuit is closed itself.
>
> If the recloser is closed and the “yellow handle” is then manually operated, going from the “up” or “closed” position to the “down” or “lock-open” position, the recloser is forced open. With the “yellow handle” in the “down” or “lock-open” position, the recloser cannot be closed via the control, because the “69” contact that supervises the close circuit is open.
>
> If the “yellow handle” is then manually operated again, going from the “down” or “lock-open” position, back to the “up” or “closed” position, the recloser remains open. But, the “69” contact that supervises the close circuit is now closed, thus allowing the control to be used to close the circuit breaker once again.

Mark’s assumption was that this “69” contact (in the close circuit) that follows the operation of the “yellow handle” on the recloser should be deemed a “69a” contact. This would result in the following definitions:

- **69a contact**: open when yellow handle is pulled to the lock-open position (drawing portrayal would be an open contact … like a traditional 52a contact is portrayed)

- **69b contact**: closed when yellow handle is pulled to the lock-open position (drawing portrayal would be an open contact with a diagonal slash through it … like a traditional 52b contact is portrayed)

Brad referenced IEEE C37.2 and confirmed the use of the "a" and "b" article attachments, where the "a" article infers a situation where equipment is in its de-energized/non-operable state. This is certainly the case for the yellow handle pulled to the lock-open position:

- The recloser is opened, de-energizing the [radial] power system beyond it
- The control cannot close the recloser

Thus, the preceding 69a contact and 69b contact definitions were agreed upon/confirmed.

10. Other discussion

Additional recloser interface signals to consider (these don't necessarily exist today in any currently offered recloser interface):

- Recloser health, especially if there is some kind of electronics up in the automatic recloser … want to communicate such information down to the control (Craig).
- Analog signal for pressure sensor (e.g., SF_6) or other use (Craig, Anil).
- Operation health indication - Trip circuit monitor

Tim suggests going back to the reclosers subcommittee meeting and ask for better clarification of what is expected from the group.
Tim & Brad - Suggest Mark ask RODE for their expectation of the deliverable this week.

11. RODE meeting feedback (Wednesday afternoon, April 25, 2018)

Tim and Brad's preceding suggestion was brought up in the main RODE meeting. It was explained by RODE that a "task force" has a longevity of a year … which is what this present Recloser Interface Task Force is up against after just two meetings. Those that have been participating in this task force feel that we are rather just getting started … discussing existing interfaces, what signals are most important, what new signal ideas might be advantageous, etc.

Thus, it was decided that Recloser Interface Task Force should be converted to a Recloser Interface Discussion Group, much like the Visible Break Discussion Group which has been ongoing for a couple of years now. Mark Feltis was instructed to make a formal request to RODE for such a conversion.

12. Next Meeting

Fall 2018: Kansas City Marriott Downtown, Kansas City, Missouri (October 14-18, 2018)

Annex

Per forthcoming IEEE privacy/security guidelines announced at the Tuesday, April 24, 2018 breakfast session, no email addresses are listed in the attendance.

Attendance			
First Name	**Last Name**	**Representing**	**April 23, 2018**
Mark	Feltis	Schweitzer Engineering Labs	x
Kate	Cummings	G&W Electric	x
Nenad	Uzelac	G&W Electric	
David	Beseda	S&C Electric	
Pete	Meyer	S&C Electric	
Frank	DeCesaro	Eaton	
Jordan	Tsvetanoff	First Energy	
Brendan	Kirkpatrick	Southern California Edison (SCE)	x
Jeff	Ward	Doble Engineering Co.	
Harry	Hirz	ABB T&B	
Jeff	Gieger	ABB T&B	
William	Ernst	ABB T&B	x
Chris	Ambrose	Federal Pacific	
Bob	Behl	ABB	x
Ian	Rokser	Eaton	x
Travis	Johnson	Xcel Energy	
Anil	Dhawan	ComEd	x
Paul	Found	BC Hydro	x
Robert	Foster	Megger	
Francois	Soulard	Hydro-Quebec	x
Craig	Thompson	Schweitzer Engineering Labs	x
Tim	Royster	Dominion Energy	x
Jacob	Midkift	Dominion Energy	x
Krystle	Carstens	ABB/Elastimold/T&B	x
Robert	Warren	DNVGL: KEMA LABS	x
Frank	Lambert	Georgia Tech NEETRAC	x
Brad	Lewis	American Electric Power (AEP)	x
Steve	Pell	Siemens	x

Materials used in presentation at the April 23, 2018 meeting:

Mark Feltis' review of IEEE Std C37.11-2014 Electrical Control for AC High-Voltage (>1000V) Circuit Breakers

- I don't believe there is anything in this standard that is directly applicable to the work of our task force.

- Clause 3. Functional Requirements discusses numerous scenarios that effectively prevent inadvertent closing of the circuit breaker. Logic in the control unit of an automatic circuit recloser does similar.

- Clause 4. Devices and auxiliaries, item d)1), says that a circuit breaker NOT intended for use in metal-clad switchgear should have available two 52a breaker contacts and two 52b breaker contacts - these are in addition to those breaker auxiliary contacts already required for proper control of the circuit breaker and its indicating lights. Many of the more recent automatic circuit recloser offerings (with single-phase operation capability) provide (via the main interface) a single 52a contact and a single 52b contact for each phase (thus, six auxiliary contacts in total are provided).

- Clause 5. Wiring requirements has eight figures that detail wiring for various breaker types (variations of circuit breaker intended/NOT intended for use in metal-clad switchgear and variations of ac or dc voltage for tripping and closing control). Specific terminal numbers are given for specific items that are to be wired up to the circuit breaker control system ... in the same "spirit," that is what we are considering doing if this task force eventually turns into a working group (i.e., coming up with specific numbering for specifc-function recloser interface pins).

Mark Feltis' review of IEEE 789-2013 Standard Performance Requirements for Communications and Control Cables for Application in High-Voltage Environments

- It appears that this standard could be useful for our task force.

- Clause 5.1 General specifies the three types of cables that the standard covers: communication, control, and instrumentation.

- The control cable definition (Clause 5.1.2) appears to cover the trip/close and 52a/52b type signalling of recloser control cables.

- The instrumentation cable definition (Clause 5.1.3) appears to cover the power system secondary currents of recloser control cables, as well as the various voltage signals (traditional and low-level secondary voltages from the power system) and power input that can be brought into the control unit enclosure.

- Clause 5.5.1 Operating voltage and Clause 5.5.2 Operating current essentially confirm that the range of respective power system secondary currents and voltages for recloser controls is covered by this standard.

- Clause 9 Cable design requirements and Clause 10 Testing and test methods both frequently refer to the following two Insulated Cable Engineers Association (ICEA) standards:
  ICEA S-84-608 Standard for Telecommunications Cable Filled, Polyolefin Insulated, Copper Conductor
  ICEA S-85-625 Standard for Telecommunications Cable Aircore, Polyolefin Insulated, Copper Conductor
  Clause 10 Testing has physical tests (Clause 10.4) and electrical tests (Clause 10.5).

- On page 2 of the minutes, the question is asked if there are applicable standards addressing coupling/crosstalk ... Clause 10.5.4 Crosstalk appears to cover this, with reference to the aforementioned ICEA standards.

- Neither myself, nor my immediate colleagues are familiar with IEEE 789-2013 (or the ICEA standards it references) from working standpoint ... what is anyone else familiarity? It appears all encompassing for the subject matter it addresses ... especially as it references the aforementioned ICEA standards (which I don't have copies of ... one can see their "table of contents" by doing an online search).

On page 2 of the October 11, 2017 minutes, mention is made of the IEEE Power Systems Instrumentation and Measurements Committee reportedly having (or being in the midst of producing) a "guide for testing smart grid sensors and intelligent electronic device systems." In the minutes, I (Mark Feltis) reported I couldn't find such at their website (anyone else have better information?), but found this recent IEEE paper that makes a lot of references to IEEE 1451 Standard for a Smart Transducer Interface for Sensors and Actuators:

- "Smart Sensors and Standard-Based Interoperability in Smart Grids" by Eugene Y. Song, Gerald J. FitzPatrick, and Kang B. Lee, IEEE Sensors Journal, Vol. 17, No. 23, December 1, 2017

- I am not familiar with IEEE 1451 from a working standpoint ... what is anyone else familiarity? The paper's discussion of IEEE 1451 especially makes mention of TEDS (transducer electronic data sheet ... or configuration file) being part of a "smart sensor." There appear to be very forward-looking ideas in this paper.

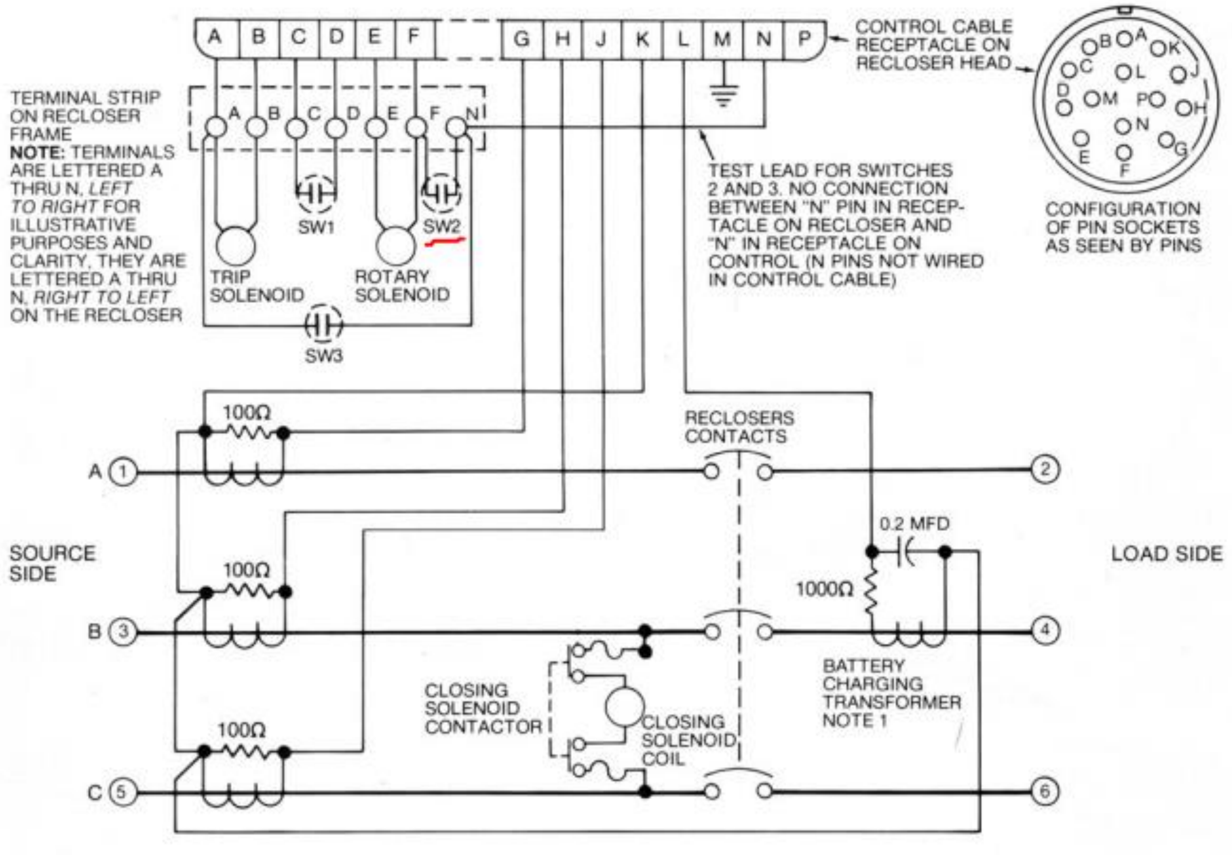
This is probably a Nenad/Francois question ... what is the difference between:

- a task force (what this interface group has been deemed)
- and a discussion group (e.g., the one for visible break)

Is there an advantage to using one classification or the other for a IEEE Switchgear meeting ... at least for the preliminary meetings, before it is turned into a working group (if approved for such)? Does one classification infer more informality? It seems that the "visible break" discussion group has been ongoing for at least a couple of years now.

Definition of Device Number 69 from Applied Protective Relaying (Westinghouse):
Permissive control device is generally a two-position, manually operated switch that in one position permits the closing of a circuit breaker, or the placing of an equipment into operation, and in the other position prevents the circuit breaker or equipment from being operated.

The following figure is from the reference: Cooper S280-40-8 Service Information, Types RVE and WVE Maintenance Instructions, September 1988, page 13, Figure 24: Internal connection diagram



SW1 - MICROSWITCH ON MAINSHAFT—CLOSED WHEN CLOSING SOLENOID PLUNGER IS DOWN

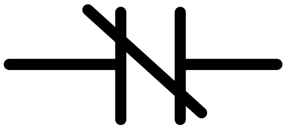
SW2 - MERCURY SWITCH ON MANUAL OPERATING HANDLE—CLOSED WHEN HANDLE IS UP ON "CLOSED" POSITION.

SW3 - MERCURY SWITCH *ON MAIN SHAFT—OPEN WHEN CLOSING SOLENOID PLUNGER IS DOWN
PLUNGER IS DOWN WHEN RECLOSER IS CLOSED

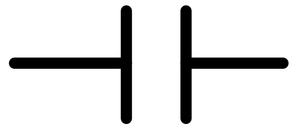
In the above figure, indicated SW2 contact is a "69 (yellow handle)" contact … it appears as a "normally open" contact. Along with the given SW2 definition above, are we to understand the SW2 contact to be a "69a" contact?

69a contact: open when yellow handle is pulled to the lock-open position (?)

69b contact: closed when yellow handle is pulled to the lock-open position (?)



69b ?



69a ?