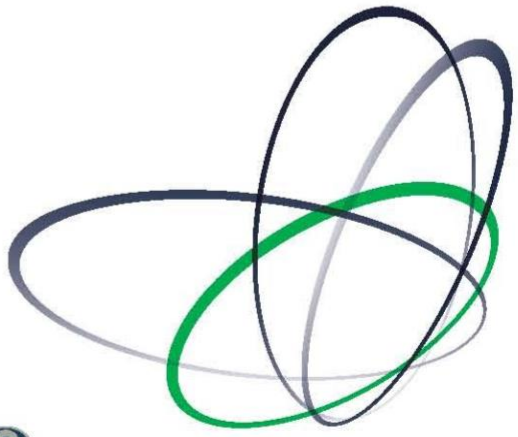
I-METER® EVCMC
USER MANUAL



i-meter®

Innovative Metering Solutions

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WARNING

Field electrical installers must follow proper safety precautions and all local electrical code requirements during electrical installation, meter wiring, and CT installation. During normal operation of this device, hazardous voltages are present which can cause severe injury or death. It is strongly recommended that only qualified, properly trained personnel should perform installation and servicing.

DISCLAIMER

The information presented in this publication has been carefully checked; however, Intellimeter Inc. (ICI) assumes no responsibility for inaccuracies. The information provided in this document is subject to change without notice.

CUSTOMER SUPPORT

To report any issue, please contact ICI at 905.839.9199. When returning any merchandise to ICI, a return material authorization (RMA) number should be obtained from ICI.

CONFIGURATION

The i-meter®45-meter series is configured by Intellimeter Inc. at ICI's Factory according to the customers provided panel schedule. However, the customer can purchase ICI's configuration Software for field configuration for a cost.

INSTALLATION CHECKLIST

Make sure you have received the right meter as per your order and packing list.

ISTALLATION DISCLAIMER

INTELLIMETER We do not accept any responsibility and will not be liable for any loss or damage or expense of any kind whatsoever and howsoever caused by improper installation of its products, be it indirect, special, incidental or consequential damages (including but not limited to damages for loss of business, loss of profits, interruption or the like.

ELECTRICAL CODE

Installer is responsible for ensuring that all safety and local electrical codes are followed.

1. INTRODUCTION

EVCMC (Electric Vehicle Charger Metering and Control) Charging Panel manages EVSE (Electric Vehicle Supply Equipment) two-way power flow to optimize grid assets and maintain grid power operational limits. The metering device is a self-contained meter and controlling device that is a modularized design. It consists of the meter module and switching modules (see Fig.1a below), which can be added from 1 to N metering and switching modules. The typical system has one 3ϕ main meter and twelve 2ϕ meters with 2-phase relay switches.

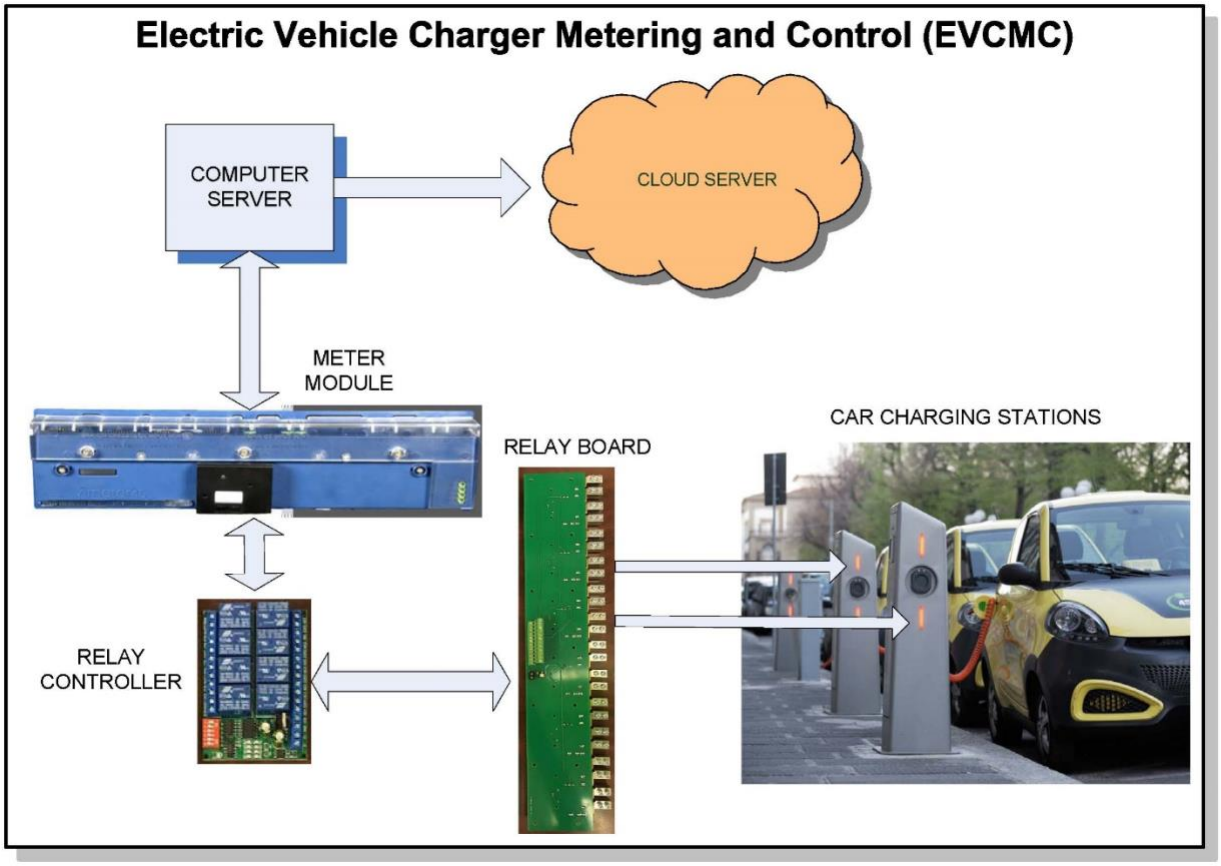

Fig.1 Intellimeter EVCMC system

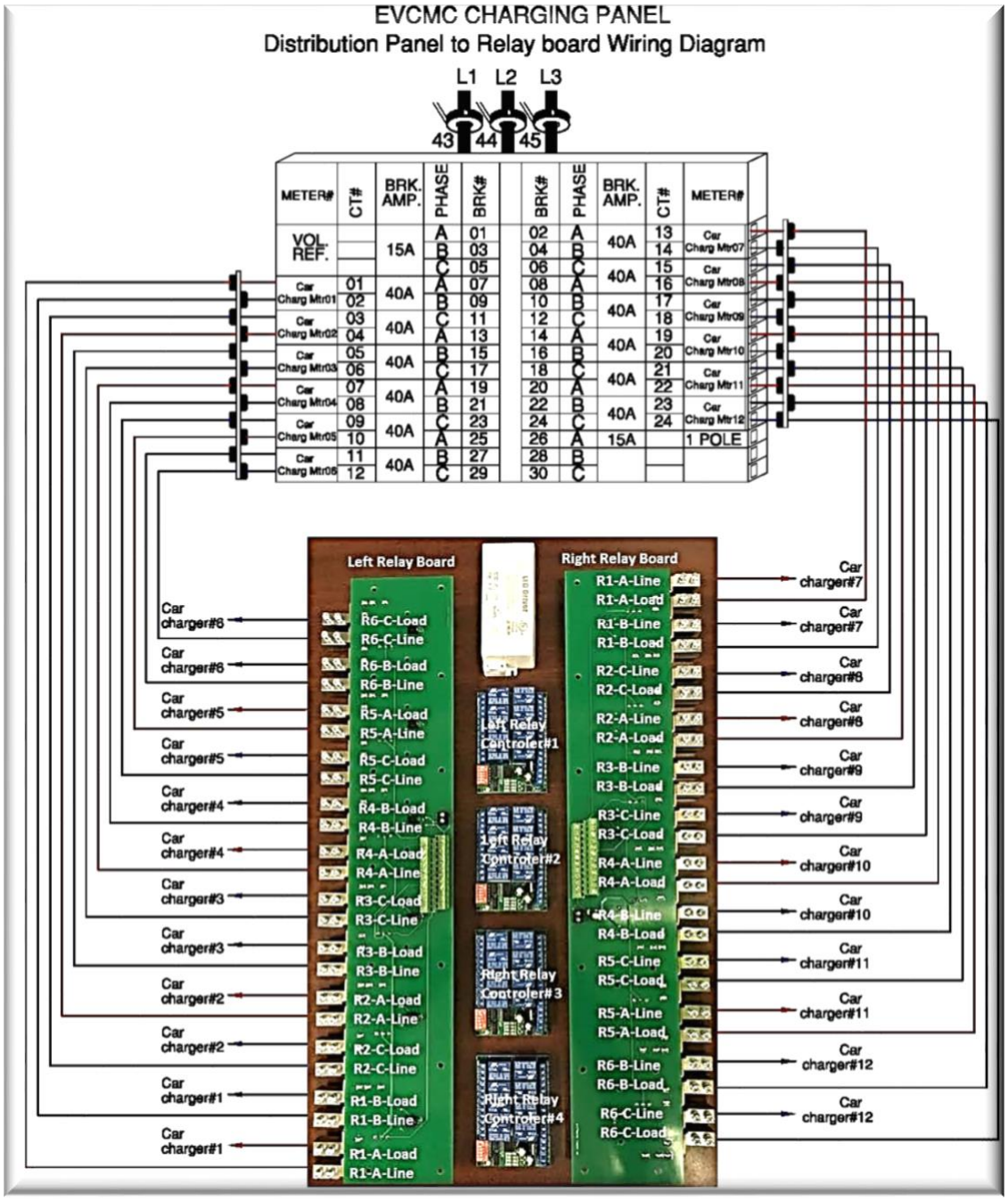

Fig.2 Typical EVCMC System

2. DESCRIPTION

EVCMC is an integrated switching control and measuring system, which has 100A or 200A current transformers for sub metering modules (or branch modules) and maximum 100A magnetic latching relay switches, and up to 400A current transformers for measuring a main load.

2.1 Metering Device

The metering device is an i-meter®45. One i-meter®45 shall be configured to have a main meter and twelve sub meters for each EVSE.

2.2 Control Device

The EVCMC is to optimize grid assets and maintain grid power operational limits for three typical EVSE that they are Level 1, Level 2 and Level 3 EVSE.

- Level 1 EVSE: 120VAC, 15-20A, 1Φ2W, Output – 1.4 kW;
- Level 2 EVSE: 208/240VAC, 80A, 1Φ3W or 2Φ3W, Output – 3.3 – 6.6kW;
- Level 3 EVSE: 120VAC – 347VAC, 2Φ3W, 3Φ4W, 3Φ3W, DC Fast Charging, Output – 25-50Kw.

3. CONTROL LOGIC

3.1 General

The metering device measures the active power W_{main} of the incoming power, and the active power W_{EVSE} of all EVSE. The controlling device shall maintain the equation (1a) true by switching ON/OFF EVSE. In similar way, EVCMC shall maintain the equation (1b).

$$W_{peak} \geq W_{main} + W_{EVSE} \quad \text{..... (1a)}$$

Where W_{EVSE} is the active power of all EVSE, W_{peak} is the limitation kW or Peak kW demand of incoming power.

$$I_{max} \geq I_{main} + I_{EVSE} \quad \text{..... (1b)}$$

Where I_{EVSE} is total current of all EVSE, I_{max} is the limitation of total incoming current.

3.2 Flowchart

Fig.3 is starting control flowchart. The control requirements are following,

- EVCMC power on – All relay switches must be OFF. Turn off all relay switches one by one, the delay time should be >100ms.
- Energize an EVSE – After turning off all relay switches, energize EVSE by turning on the relay-switch 1 to N, see the control details in Fig.3.
  Fig.4 is control logic to maintain equation 1 being true. In other words, the EVCMC measures the load of each EVSE and maintains total kW of the panel under the peak kW (W_{peak}) or the maximum current limitation (I_{max}).

  Note:
- Measuring/controlling period shall be 60s or 1min;
- Switch ON EVSE, which has the least load, $W_{min}(m)$;
- Switch OFF EVSE, which has the least load, $W_{min}(m)$ and $T_{on}(m)$>30min.
  Note: $T_{on}(m)$>30min can be ignored if there is no EVSE to meet the criteria;
- Switch ON the EVSE, which has been OFF for 4 hours. Switch OFF other EVSE if equation 1 is not true.
- Logged parameters for each EVSE with time stamp
  - Total energy consumption (kWh): E_m
  - Time OFF (min): $T_{off}(m)$
  - Time ON (min): $T_{on}(m)$
  - Voltage, Current and Wattage per phase: $V_a(m)$, $V_b(m)$, $V_c(m)$, $I_a(m)$, $I_b(m)$, $I_c(m)$, $W_a(m)$, $W_b(m)$, $W_c(m)$;
  - Voltage & Current THD per phase: V_a-THD(m), V_b-THD(m), V_c-THD(m), I_a-THD(m), I_b-THD(m), I_c-THD(m)
  - EVSE ID (Reserved for future use): 20 characters

Where the m is the EVSE number, 1 to N.

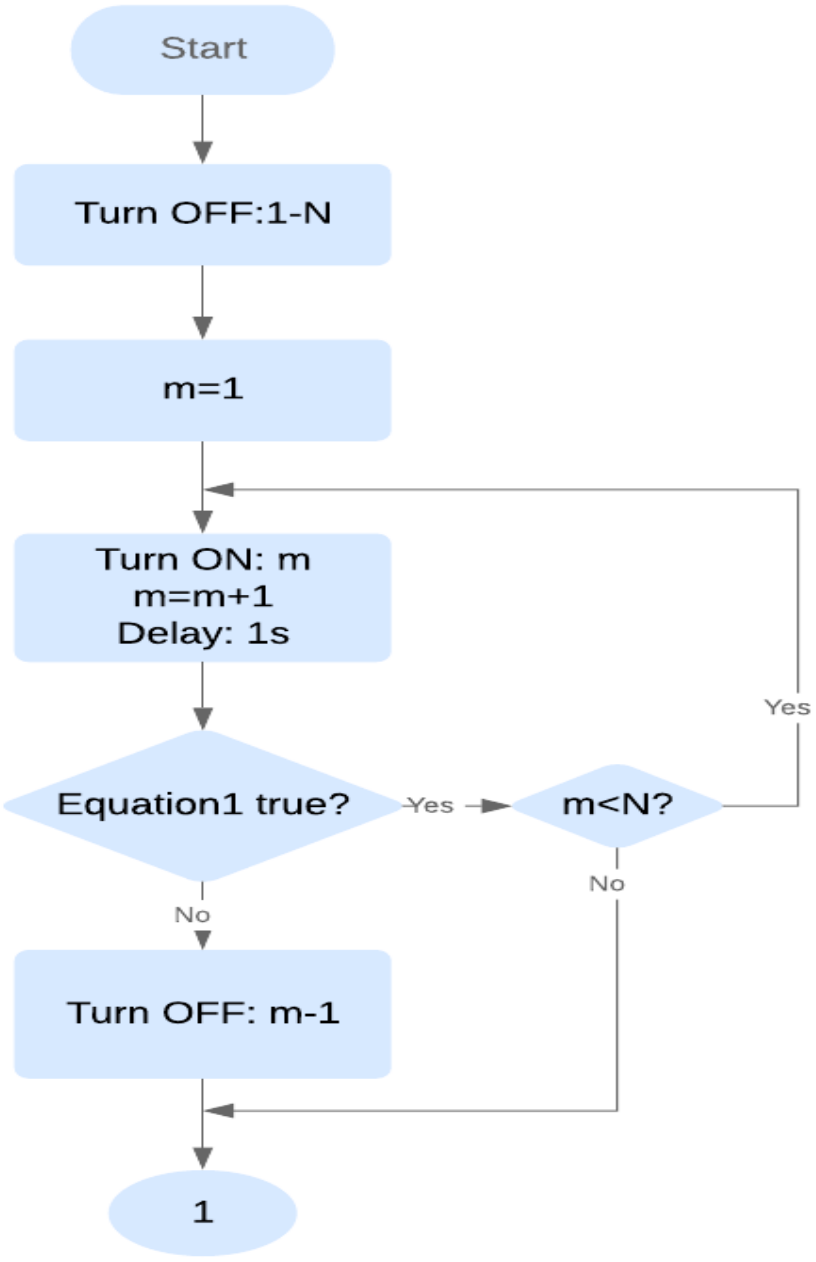

Fig.3 Starting control

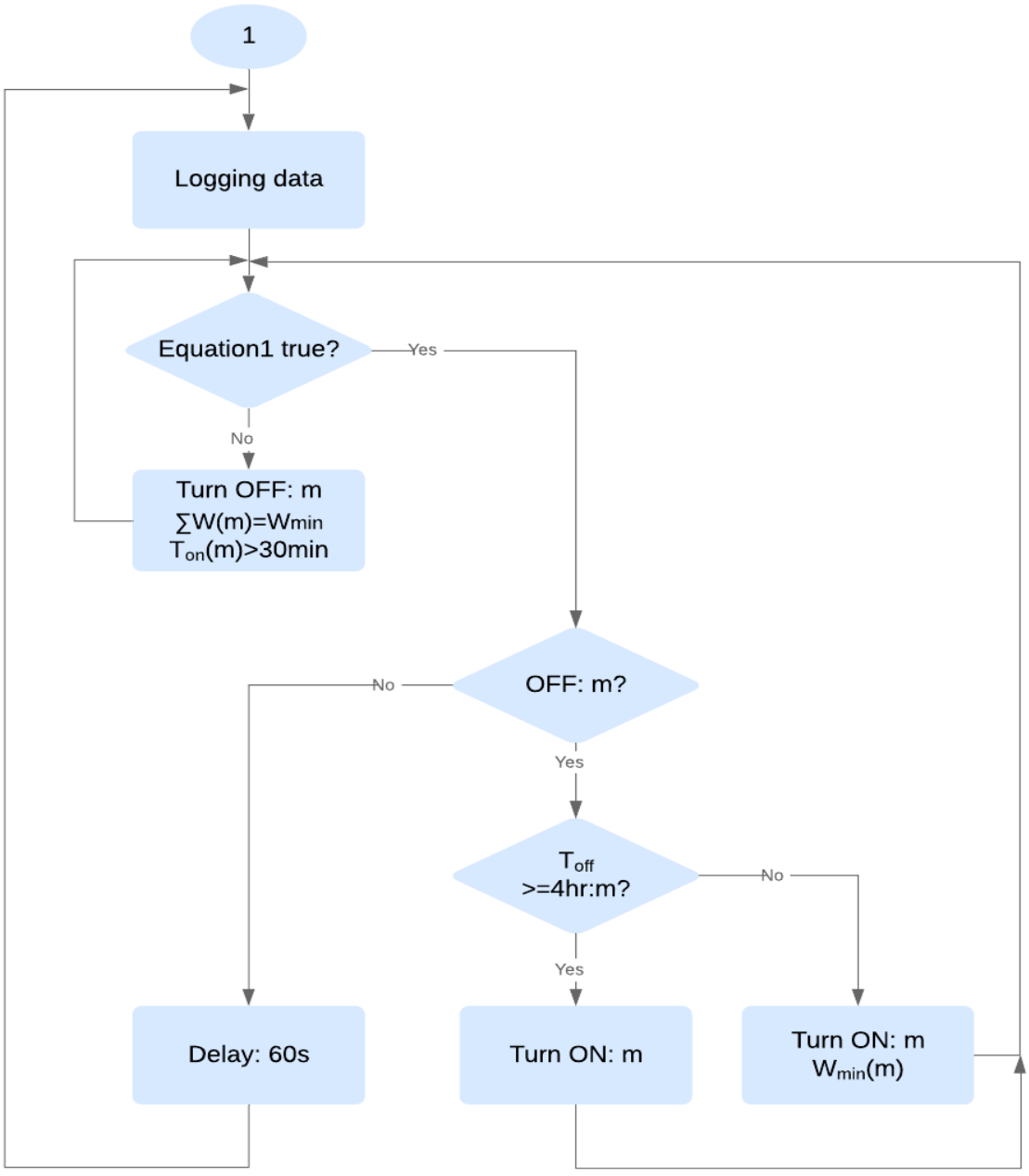

Fig.4 Flowchart2-Switch ON/OFF

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3.3 Control Threshold

EVCMC prevents relay switches from vibration by using a threshold of ±5% of the maximum limitation. For an example, the W_{peak} is 90kW, so $W_{peak\text{-}top}$ is 9.45kW, $W_{peak\text{-}bottom}$ is 85.5kW. In this case, the $W_{peak\text{-}top}$ shall be used in equation 1 while in switching OFF control process and the $W_{peak\text{-}bottom}$ shall be used in equation 1 while in switching ON control process. The threshold can be setup to other value depending on the system requirements, but $W_{peak\text{-}top}$ must be less than or equal to the absolute maximum W_{peak} or I_{max}.

4. TYPICAL EVCMC SYSTEM

4.1 The i-meter®45 configuration

Meter	Va	Vb	Vc	CustId	CustInfo	CTRatio	Current	Voltage	Service type	Meter Constant(Kp)
1	CT1	CT2		MTR #1	XXXXXXX-1	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
2	CT4		CT3	MTR #2	XXXXXXX-2	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
3		CT5	CT6	MTR #3	XXXXXXX-3	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
4	CT7	CT8		MTR #4	XXXXXXX-4	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
5	CT10		CT9	MTR #5	XXXXXXX-5	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
6		CT11	CT12	MTR #6	XXXXXXX-6	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
7	CT13	CT14		MTR #7	XXXXXXX-7	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
8	CT16		CT15	MTR #8	XXXXXXX-8	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
9		CT17	CT18	MTR #9	XXXXXXX-9	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
10	CT19	CT20		MTR #10	XXXXXXX-10	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
11			CT21	MTR #11	XXXXXXX-11	125:0.1	1-100A	120-347V L-N	1-phase, 2W	10Wh/pulse
12	CT22	CT23		MTR #12	XXXXXXX-12	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
13	CT25		CT24	MTR #13	XXXXXXX-13	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
14		CT26	CT27	MTR #14	XXXXXXX-14	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
15	CT28	CT29		MTR #15	XXXXXXX-15	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
16	CT31		CT30	MTR #16	XXXXXXX-16	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
17		CT32	CT33	MTR #17	XXXXXXX-17	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
18	CT34			MTR #18	XXXXXXX-18	125:0.1	1-100A	120-347V L-N	1-phase, 2W	10Wh/pulse
19		CT35	CT36	MTR #19	XXXXXXX-19	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
20	CT37	CT38		MTR #20	XXXXXXX-20	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
21	CT40		CT39	MTR #21	XXXXXXX-21	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
22		CT41	CT42	MTR #22	XXXXXXX-22	125:0.1	1-100A	120-347V L-N	2EL, 3W	10Wh/pulse
Main	CT43	CT44	CT45	MAIN	XXXXXXX-0	400:0.1	4-400A	120-347V L-N	3EL, 4W	10Wh/pulse

Fig.5 i-meter®45 configuration

4.2 ModBus ID of EVCMC

Table 1. Meters & ModBus Relays & Car charging relay switches

Meter		ModBus Relay		2-ϕ Relay Switch	
Meter No.	ModBus ID & Start Register	ModBus ID	Relay No.	Car Charging No.	Control Car Charging
1	5 & 41200	1	L-C1-NO1	1	Close
		2	L-C2-NO1		Open
2	5 & 41300	1	L-C1-NO2	2	Close
		2	L-C2-NO2		Open
3	5 & 41400	1	L-C1-NO3	3	Close
		2	L-C2-NO3		Open
4	5 & 41500	1	L-C1-NO4	4	Close
		2	L-C2-NO4		Open
5	5 & 41600	1	L-C1-NO5	5	Close
		2	L-C2-NO5		Open
6	5 & 41700	1	L-C1-NO6	6	Close
		2	L-C2-NO6		Open
12	5 & 42300	3	R-C3-NO1	7	Close
		4	R-C4-NO1		Open
13	5 & 42400	3	R-C3-NO2	8	Close
		4	R-C4-NO2		Open
14	5 & 42500	3	R-C3-NO3	9	Close
		4	R-C4-NO3		Open
15	5 & 42600	3	R-C3-NO4	10	Close
		4	R-C4-NO4		Open
16	5 & 42700	3	R-C3-NO5	11	Close
		4	R-C4-NO5		Open
17	5 & 42800	3	R-C3-NO6	12	Close
		4	R-C4-NO6		Open
MAIN	5 & 41100	n/a	n/a	n/a	

4.3 Typical panel parameters

The typical panel shall use Equation (1b) to control the panel. The typical panel includes 12 two-phase meters and 12 two-phase relay switches.
See the control parameters below,

- I_{max}=3X230A=690;
- I_{EVSE} total current of each meter. In the typical panel, all 12 meters are two phase network meters, so total current is sum of two-phase currents;
- I_{main} is the main meter total current, which is sum of three-phase currents;
- N is 12.
- Threshold is 655.5A to 724.5A

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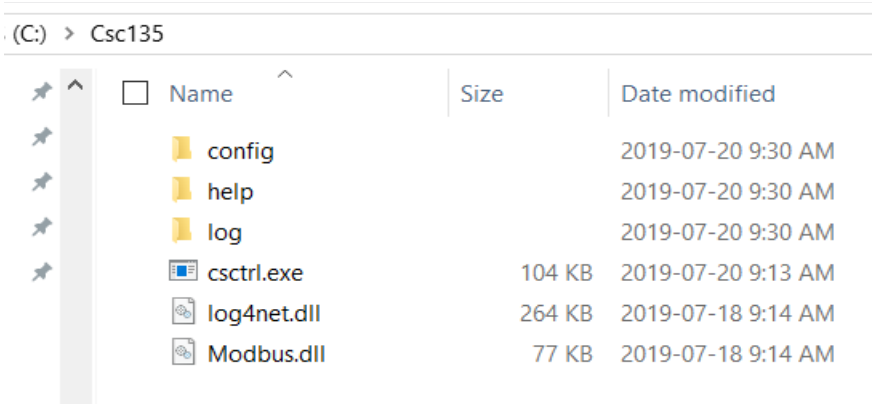
5. SOFTWARE INSTALLATION

5.1 Install Software

Extract Csc135.zip to the drive C:\

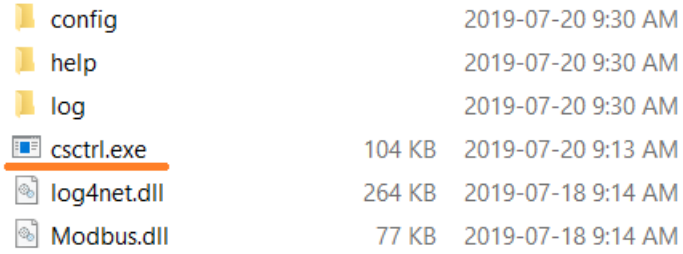
5.2 Install Software

Extract Csc135.zip to the drive C:\



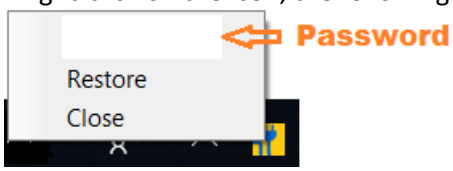
5.3 Software Start

Execute **csctrl.exe** in the software package C:\Csc135



The icon of the software appears on Task Bar.

Right-click on the icon, the following penal appears.

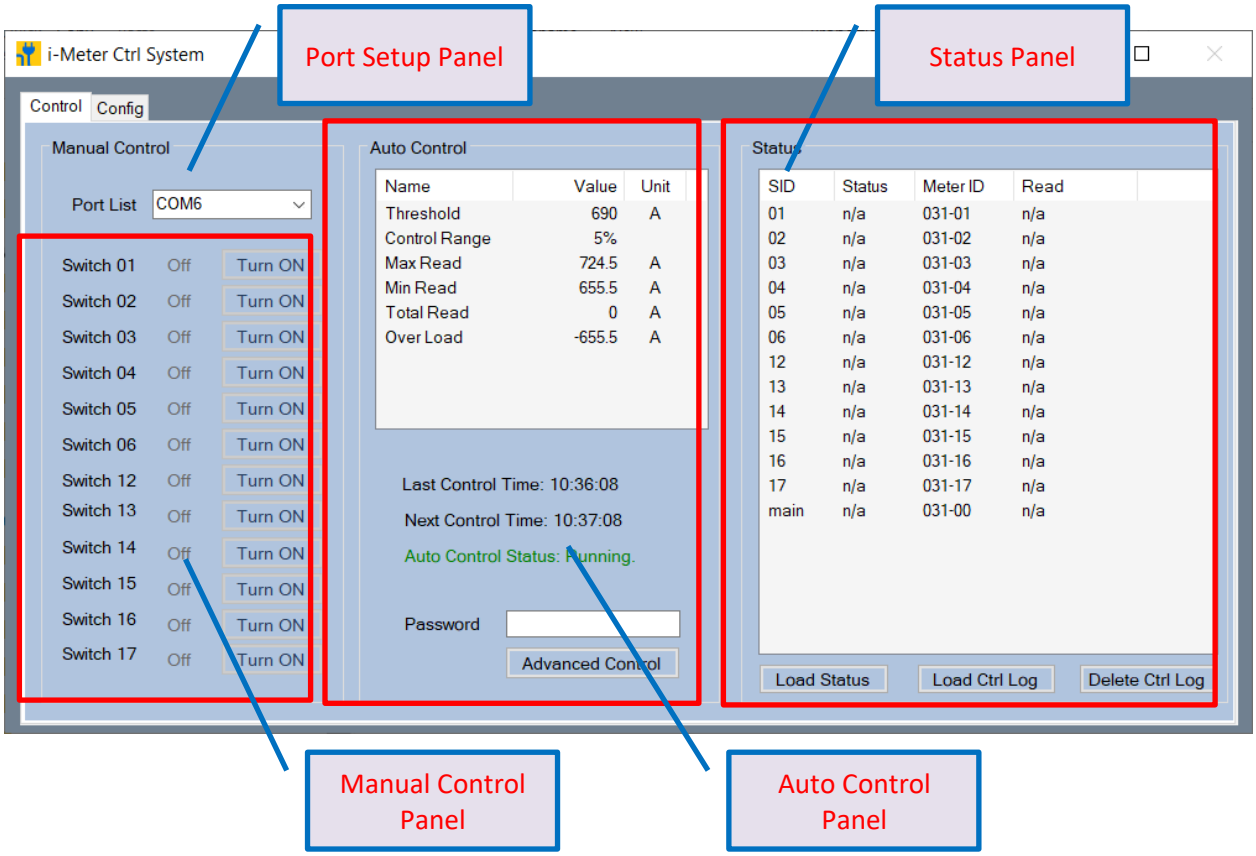


Input password (default is 000000) and click the button Restore, the User Interface appears

5.4 Interface

5.4.1 Control function tab consists four components:

Port Setup Panel: To select connected COM Port Number from the list;
Manual Control Panel: To manually change status of Switch;
Auto Control Panel: To monitor the status of auto control;
Status Panel: To show the current status and log;



Manual Control: input password and click the button Advanced Control, the buttons of manual control are enabled.

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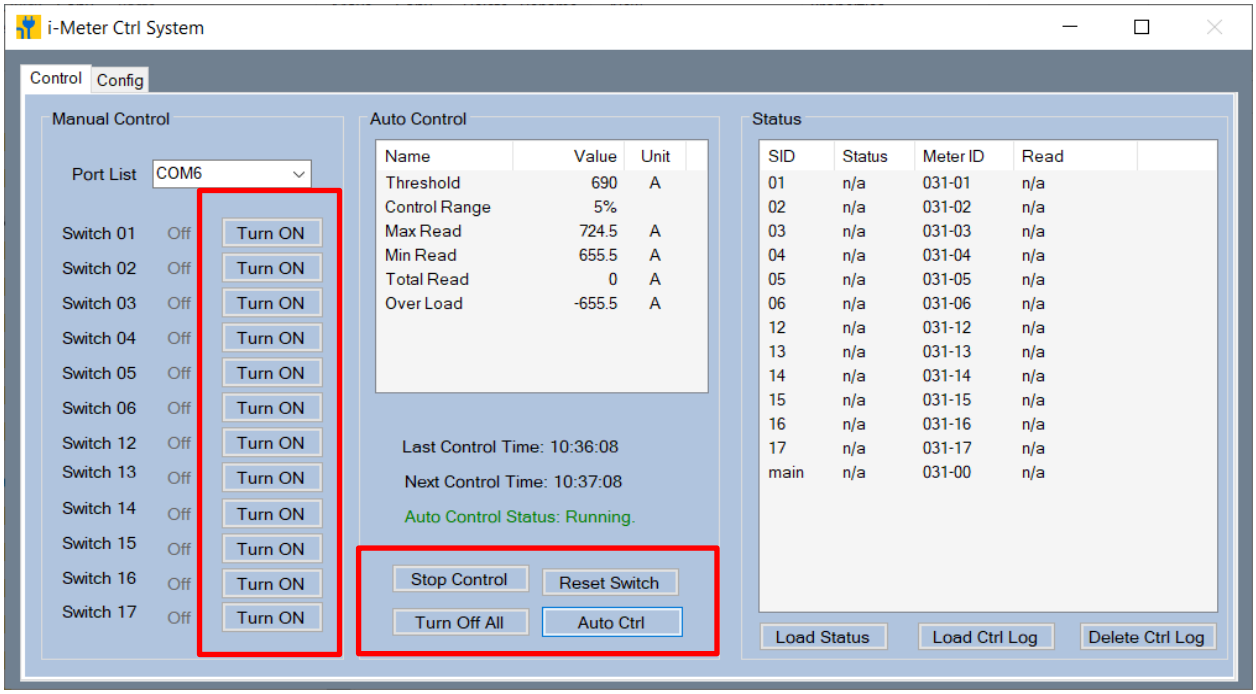
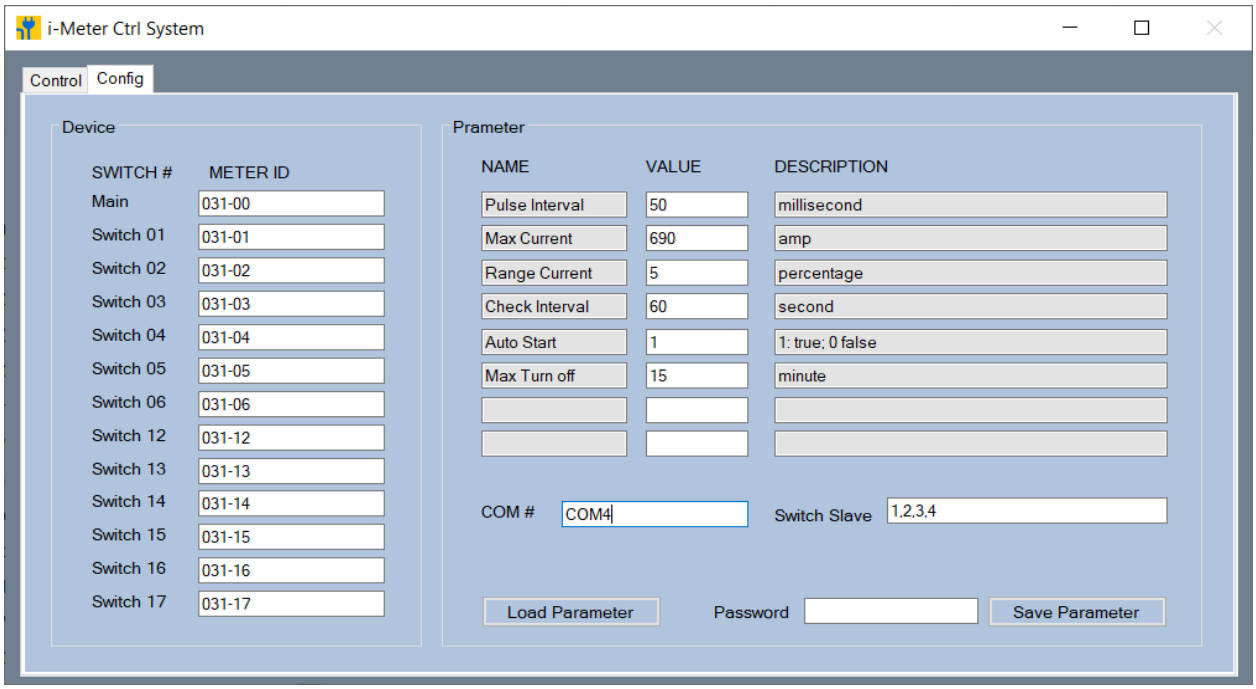


5.4.2 **Parameter** function tab is to load and save the configuration of control parameters



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COM #: port number that is used to communicate the Relay. If designated COM number is available port of the computer, the parameter will be loaded as the default port number when csctrl.exe get started.

Switch Slave: Slave ID of the Switch;

Meter ID: Setup the mapping of Switch and Modbus meters: format of meter id is AAA-BB, AAA is Modbus id and BB is channel number;

Pulse Interval: The pulse interval of control relay;
Max Current: Threshold of control;

Range Current: Range Percentage of control;
Example) Max Current = 690, Range Current = 5%:
iCtrl software will switch off meter(s) if Total Read exceeds **690** * (100%+**10%**) amp
iCtrl software will switch on meter(s) if Total Read is lower than **690** * (100%-**10%**) amp

Check Interval: The frequency the software will check the meter reading, total read and execute command;

Auto Start: 1: Auto control model; 0: Manual control model

Max Turn off Time: Switch maximum turn off time

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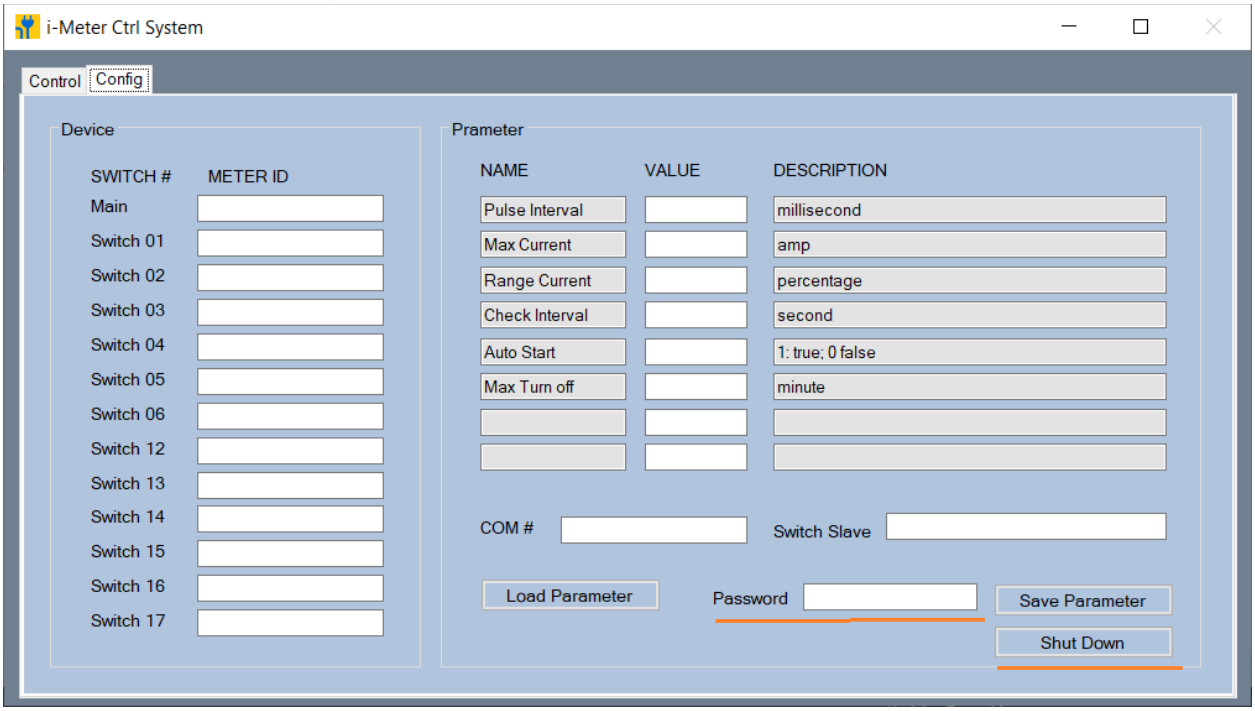
5.5 Close Software

5.5.1 When User Interface window is maximum status, go to Config tab. Input password and click the button Shut Down, the software turns all switches off and then shuts down.



5.5.2 When User Interface window is minimum status

Right-click on the icon, the following penal appears.

Input password and click the button Close, the software turns all switches off and then shuts down.

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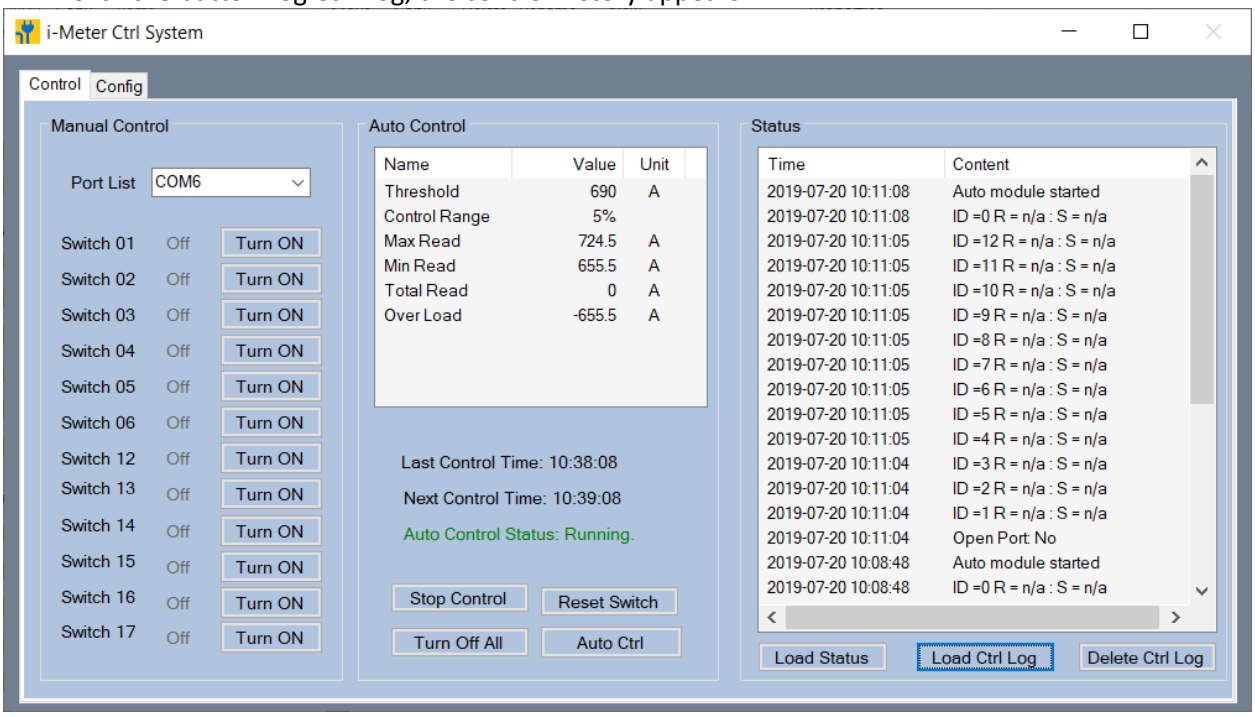
5.6 View Log

Click the button Log Ctrl Log, the control history appears.



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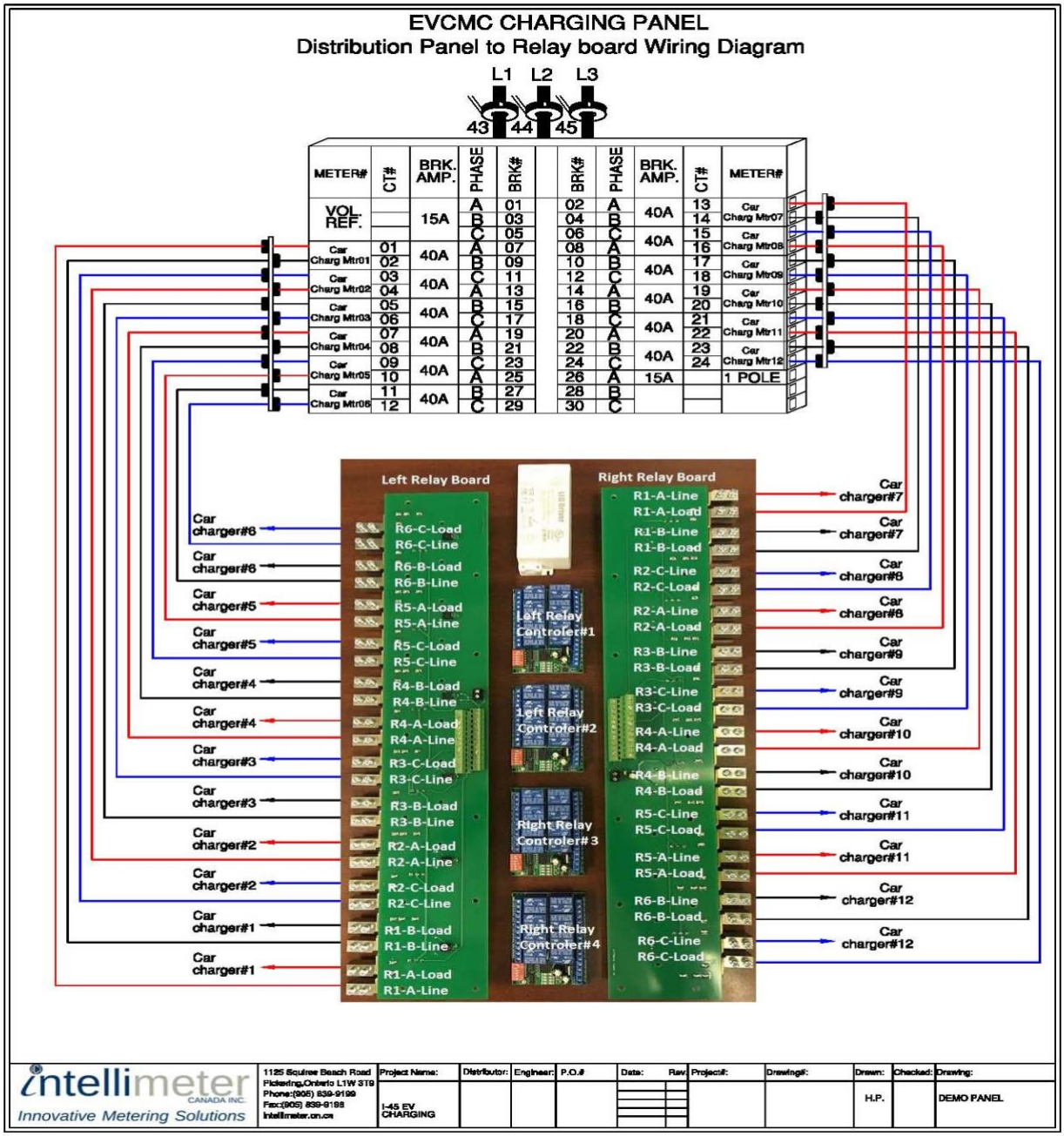
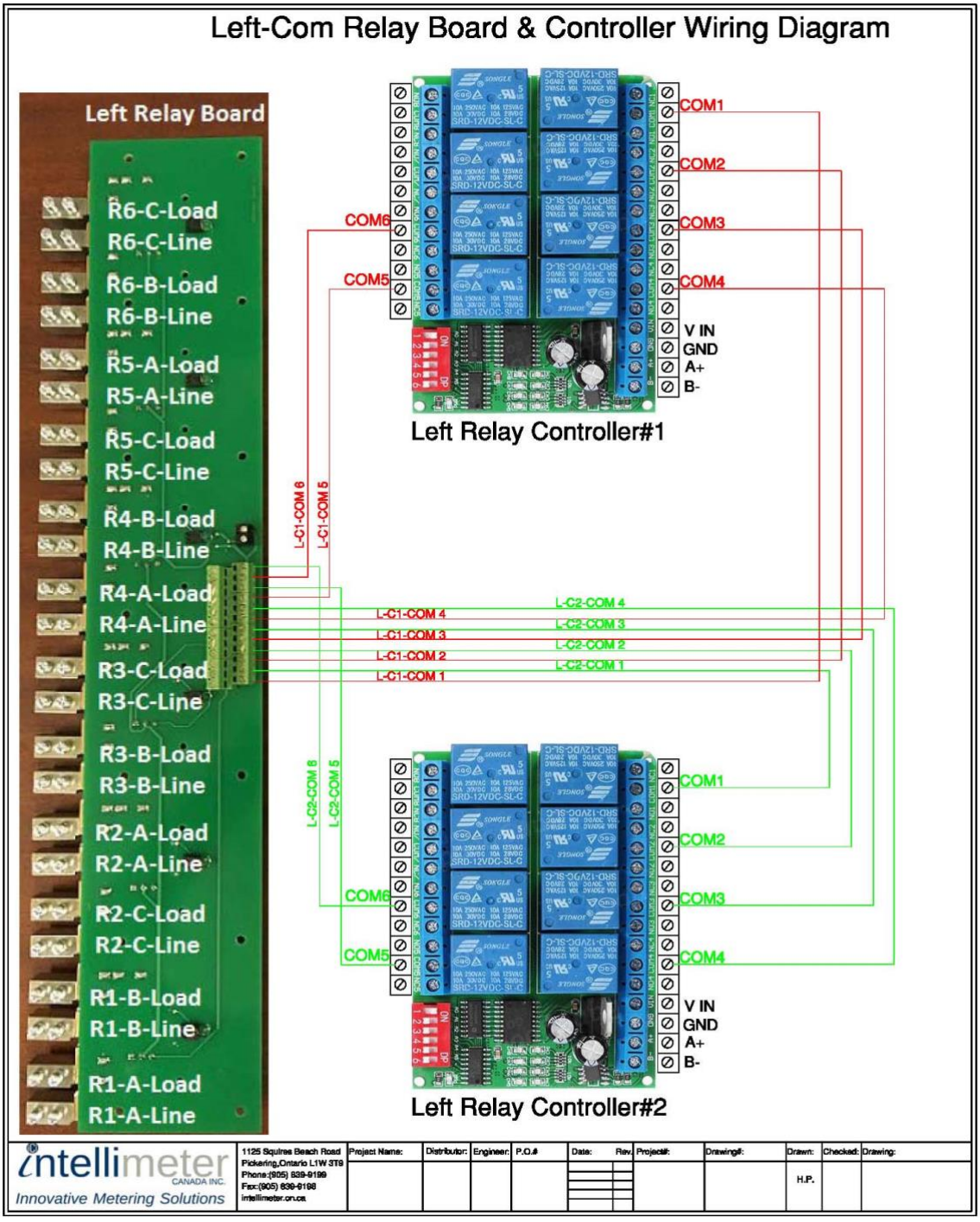
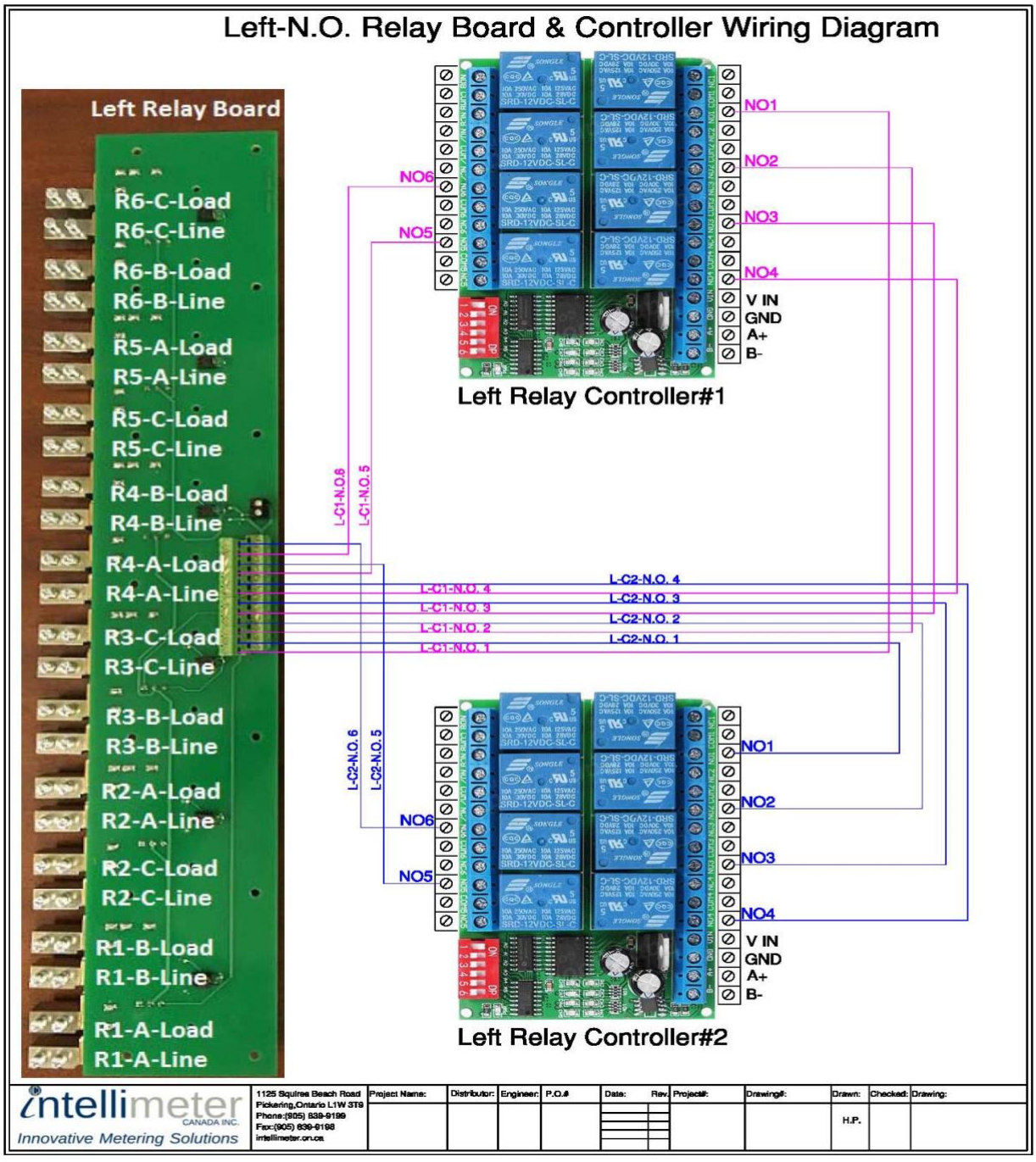
Appendix 1 – EVCMC charging panel



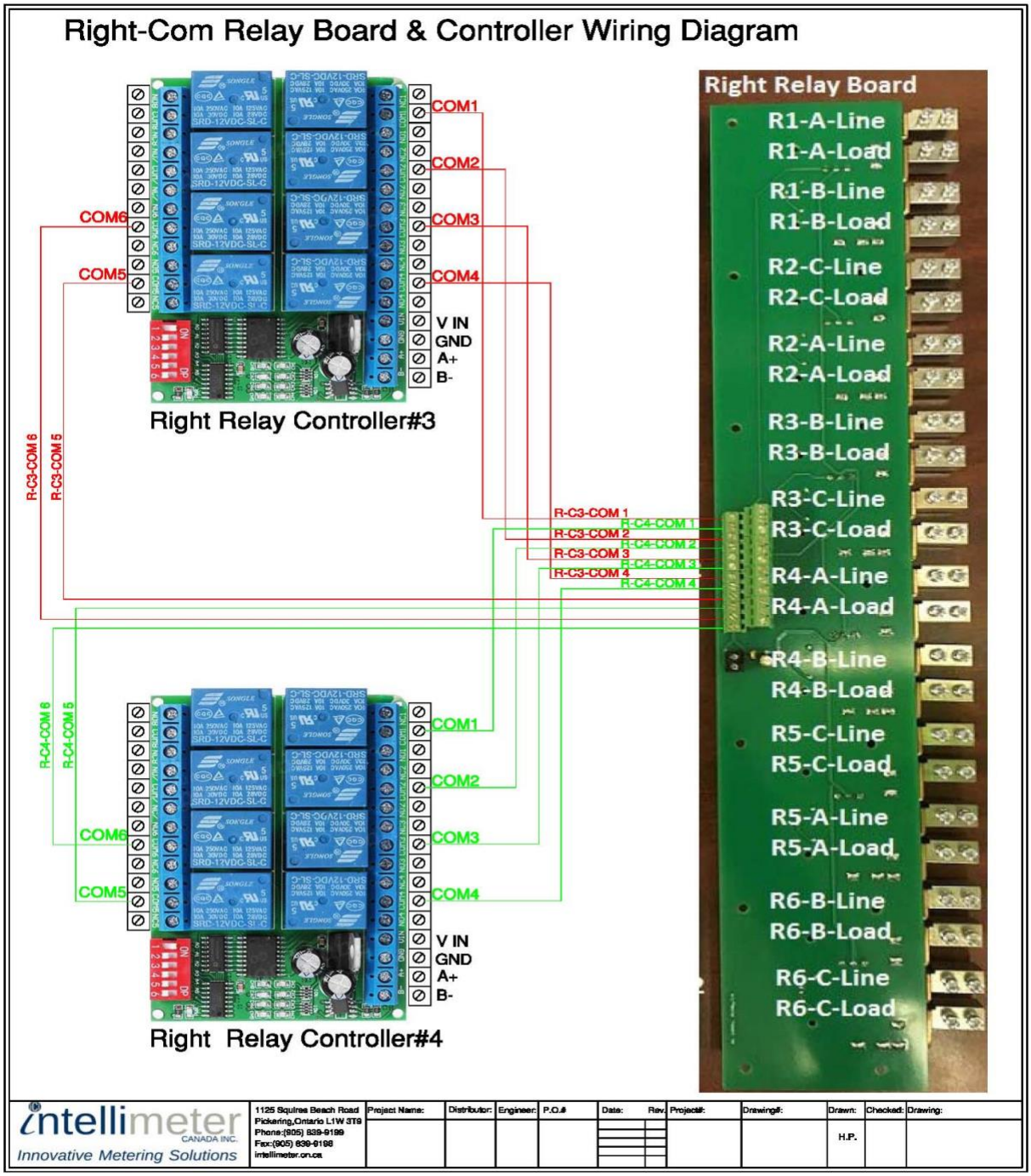
Appendix 2 – Left-Com Relay & Control



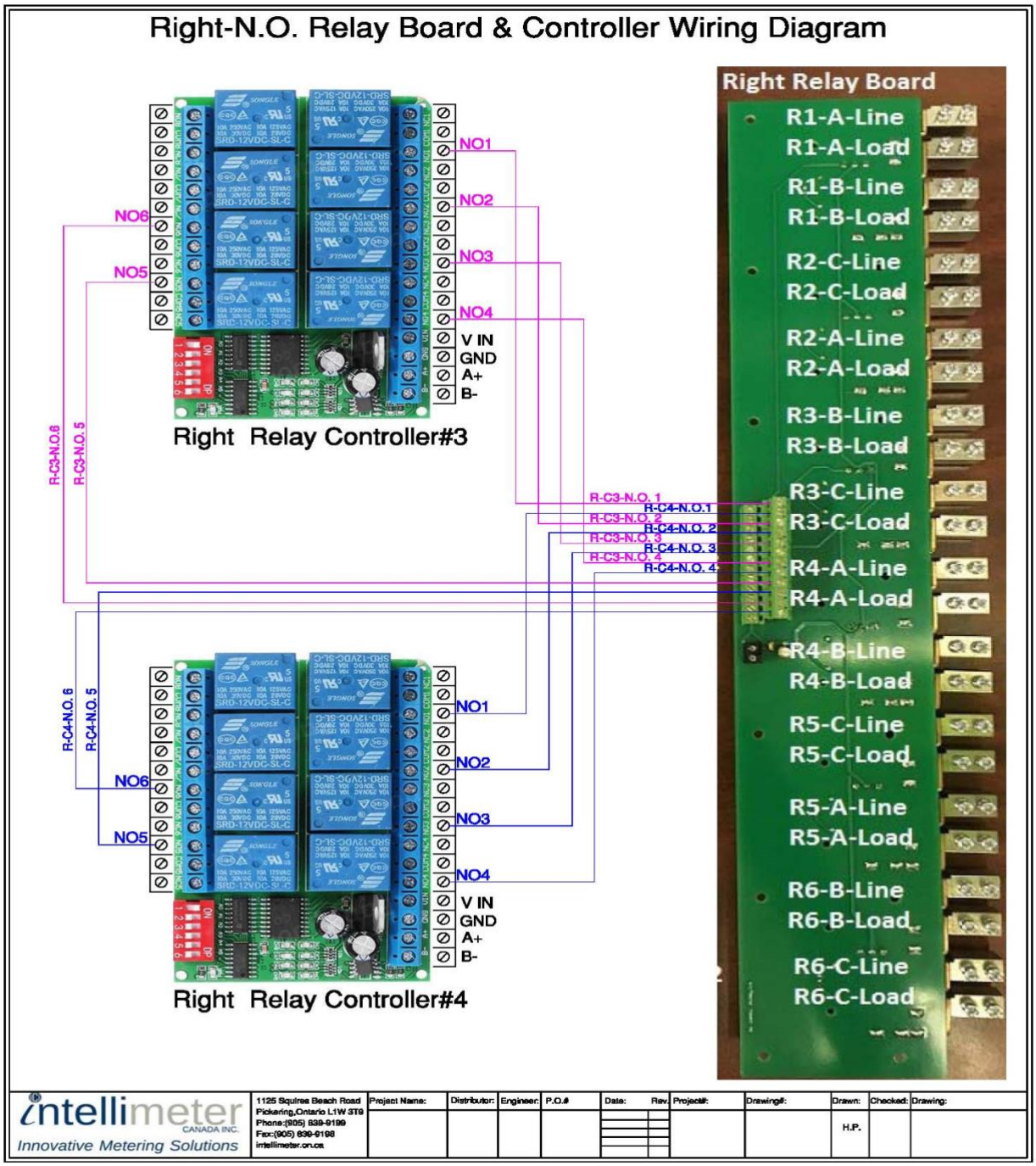
Appendix 3 – Left-NO. Relay & Control



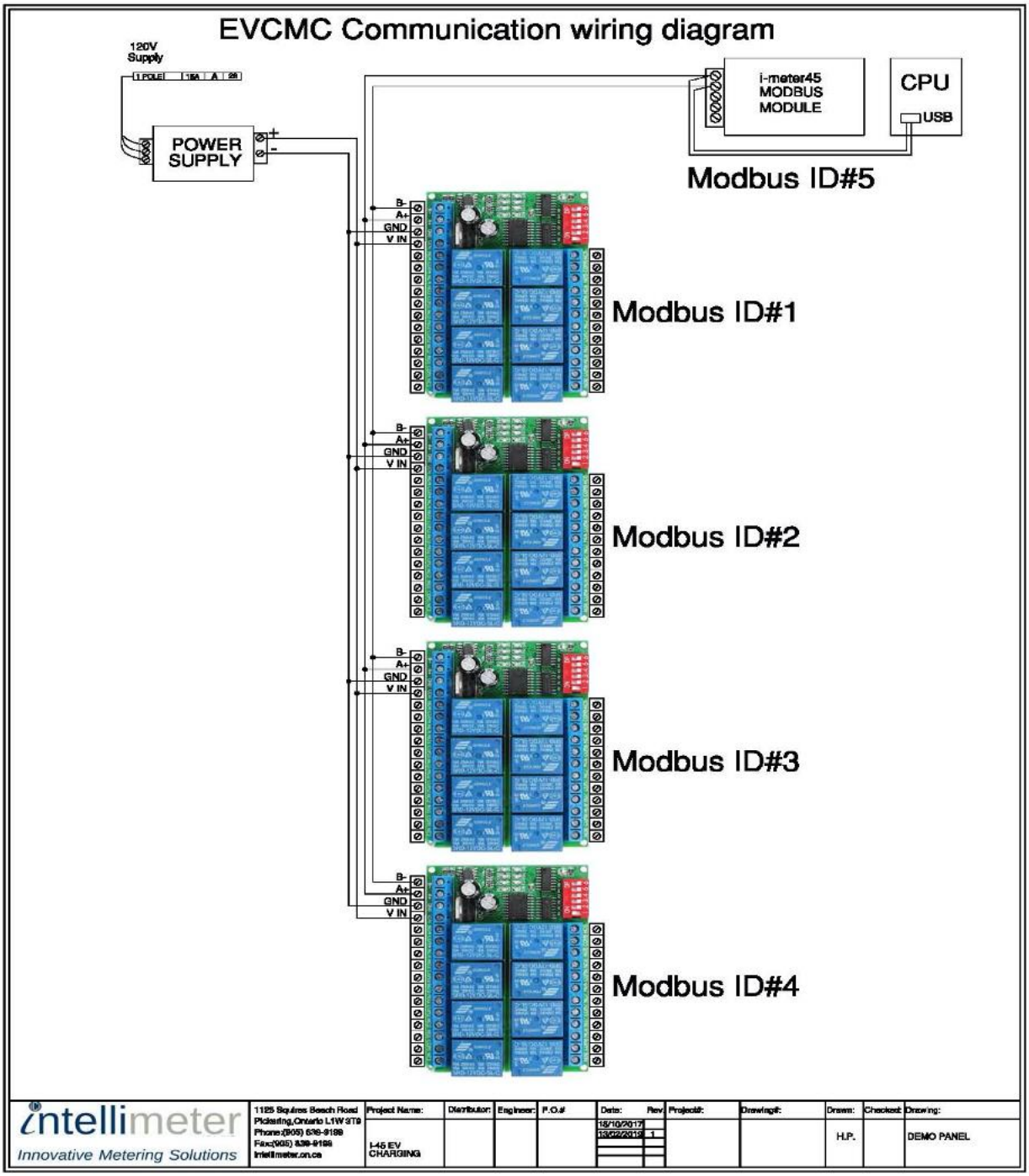
Appendix 4 – Right-COM Relay & Control



Appendix 5 – Right-NO. Relay & Control



Appendix 6 – EVCMC Communication



Terms and Conditions of Sale

1. **Contract Terms**

All contracts for the sale of goods and services concluded between Intellimeter Inc. (hereinafter called "ICI") and the purchaser, (hereinafter called the "Purchaser") are subject to the following terms and conditions. Any variation from the terms and conditions herein contained will require written consent of ICI signed by its duly authorized representative. Purchase orders received from the Purchaser for ICI products will be subject to the standard ICI terms and conditions. ICI will not be bound by any terms and conditions or pricing stated on the purchase order, unless agreed to in writing by ICI.

2. Prices, Shipping, Taxes, and Tariffs

Unless otherwise stated, prices quoted are valid for acceptance for a period of 30 days from issuance of quote. Should the decision to accept our offer be delayed to a later date, we would be pleased to either confirm our offer or re-bid.

Unless otherwise stated, prices do not include the arrangement and cost of a utility shutdown which must be arranged, by the Purchaser, directly with the Utility Provider. Unless otherwise stated, prices do not include any external wiring or any cabling from the equipment. Unless otherwise stated, prices are EXW ICI. Shipping charges are extra and quoted prices do not include taxes. Prices quoted are based on foreign exchange rates, customs tariffs and other direct taxes in effect at the date of quotation. Any changes in foreign exchange rates, sales taxes, customs tariffs or other taxes shall be the responsibility of the Purchaser in Canadian funds, unless otherwise stated.

3. Terms of Payment

Terms are net 30 days from date of invoice subject to prior credit approval. Late payments will be subject to interest charges at the rate of twenty-four percent (24%) per annum (2% per month), calculated daily.

Invoices for pro-rata shipments become due Net 30 days from the date of shipment. If at Purchasers' request, shipments are delayed, payments for the product will be invoiced to the Purchaser to the extent of completion, as a percentage of the total contract price. Equipment held for the Purchaser shall be at the risk and expense of the Purchaser

4. **Delivery**

Delivery dates quoted are subject to confirmation at the time of contract awarding. All confirmed dates are based on the prompt receipt by ICI of all necessary information enabling work to proceed without interruption.

When the contract is for the supply and commission of equipment, a delivery date will be established at the time of contract awarding. Should the installation of the equipment be delayed beyond that date, ICI reserves the right to invoice for the supply portion of the contract and ship or place the material into storage at the Purchaser's option and expense.

Force Majeure

ICI will not be liable for any non-performance or delay of a contract if it is due to any cause beyond the reasonable control of ICI and/or for which ICI could not reasonably foresee or provide against and which prevents ICI from carrying out the terms of the contract. This includes, but is not limited to the following: war, revolution, insurrection or hostilities (whether declared or not), riot, civil commotion or uprising, flood, earthquake, tempest, hurricane, lightning or other natural disasters, fire or explosion, strike, lockout or other industrial disturbance (whether at ICI or one of its suppliers), sabotage, accident, embargo, car shortage, wrecks or delays in transportation, non-delivery of materials, or order or action of government authority. Any delay resulting from such cause shall extend the date of delivery accordingly. ICI reserves the right to cancel the contract if in its opinion such circumstances threaten or cause extended delay in the performance thereof.

6. Cancellation

Purchase orders placed by the Purchaser and accepted by ICI may be cancelled only with the written consent of ICI. A cancellation charge may be payable by the Purchaser to cover costs, including design and engineering, drawing preparation, materials purchased and production costs incurred to a maximum of 100% of the selling price.

7. Liability

ICI shall not be liable for any damages arising from the use of the goods supplied hereunder, or for any special, indirect or consequential damages arising from delays, however caused, through non-delivery, or through defects in materials or workmanship or from any other cause whatsoever. No claim of any kind whether as to a product delivery or for non-delivery of a product, shall be greater in amount than the purchase price of the product in respect of which the claim is made

8. Warranty

This Limited Warranty is effective only for a period of (12 months from commissioning or 18 months from delivery, whichever occurs first; when stored and/or installed in accordance with product instructions by qualified personnel. This limited warranty will apply when product is used and maintained in accordance with Intellimeter Inc. (hereafter referred to as ICI) guidelines which include, but are not limited to, the information contained in ICI Terms and Conditions for Sale of Products and/or Services, Specifications and Installation Instructions

ICI must be notified of the defect within thirty (30) days after the defect becomes apparent or known.

Buyer’s remedies shall be limited to replacement only of the product which failed to conform to ICI’s express warranty set forth

above. Replacement product shall be identical to original product supplied.
Buyer shall be responsible for all freight costs and shall bear all risk of loss or damage to returned goods while in transit.
This Limited Warranty does not cover installation, removal, reinstallation, or labor costs, and excludes normal wear and tear. Buyer shall provide labor for the removal of the defective component or item and installation of its replacement at no charge to ICI.
This Limited Warranty does not cover any product if: (i) a product is altered or modified from its original manufactured condition, (ii) any repairs, alterations or other work has been performed by Buyer or others on such item, other than work performed with ICI's authorization and according to its approved procedures; (iii) the alleged defect is a result of abuse, misuse, improper maintenance, improper installation, accident or the negligence of any party; (iv) damaged as a result of events beyond ICI's control or other force majeure events or (v) used in conjunction with equipment, components, accessories, parts or materials not supplied or approved by ICI.
This Limited Warranty is limited to the obligation to replace the manufactured product. This is the sole and exclusive remedy for any breach of warranty. IN NO EVENT SHALL INTELLIMETER BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES (INCLUDING ANY DAMAGE FOR LOST PROFITS) ARISING OUT OF OR IN CONNECTION WITH THE FURNISHING OF PRODUCTS, PARTS OR SERVICES, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE ANY PRODUCTS, PARTS OR SERVICES, SALE OF OR OTHERWISE, WHETHER BASED IN CONTRACT, WARRANTY, TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, OR ANY OTHER LEGAL OR EQUITABLE THEORY.
ICI shall pass on the benefit of any warranties from suppliers of materials, software, and service used in supplied systems. The Purchaser acknowledges that any attempt to repair, service, or tamper with products supplied by ICI, by other than ICI or its authorized service provider will invalidate the warranty.

9. Commissioning
Unless otherwise stated, our commissioning services, if quoted, are limited to one site visit not exceeding four (4 hours) of service time. Additional visits will be charged at the standard rates effective at the date the service is performed.

10. Loss or Damage of Goods in Transit
Delivery of goods by ICI will be deemed to be made to the Purchaser upon obtaining a signed receipt from the carrier showing receipt of the goods in good order. Title to the goods will remain with ICI until payment in full is made by the Purchaser and all risk for safekeeping and condition of the goods will become the responsibility of the Purchaser upon deemed delivered.
ICI is not liable for any loss or damage, delay or non-delivery. ICI's responsibility ceases upon receipt of acknowledgment in writing from the carrier of shipments in good order.

11. Safety
Site and working conditions must meet conditions as laid out in the applicable Health and Safety Act and Regulations.
No ICI employee is required to work on equipment which has not, in his or her sole opinion, been placed in an electrically safe state for the work to be performed. It is at the sole discretion of ICI to accept the safety procedures, working conditions and required number of support staff to commence with the work. The purchaser shall supply to ICI at the request of ICI and at no cost to ICI a qualified tradesman when working on equipment.

12. Governing Law
The terms, provisions and conditions hereof and all matters arising out of the execution, construction, interpretation or breach thereof, are to be governed by the laws of New York, USA. ICI agrees to bring any action claims or legal proceedings in any way pertaining to this order, or the execution, construction, interpretation or breach thereof in the courts of the jurisdiction specified above and in no other court or tribunal whatsoever.

We reserve the right to correct clerical errors.

Thank you for giving us the opportunity to serve you. We appreciate your business and the confidence you have placed in us.

Please visit us @ https://intellimeter.us/

or call us @ 905-839-9199 if you need any further assistance.

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