Pi Innovo LLC
47047 W. Five Mile Road, Plymouth, MI 48170-3765
Tel: +1 734 656 0140 Fax: +1 734 656 0141
pi-innovo.com

Memo

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Subject: CCS Communication explanation

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EVSE charging interface

This ECU hardware is designed to support different charge control interfaces such as J1772, CHAdeMO and GB/T. Both AC and DC charging can be supported by this ECU, however the OpenECU platform software currently only supports DIN SPEC 70121:2014-12 for DC charging.

Note: Some acronyms as defined by the charging standard are as follows: PE – Protective Earth, CP – Control Pilot, PP – Proximity Pilot, CC – Charging Confirmation, CC2 – Charge Confirmation 2.

The ECU supports a QCA chipset for implementing the Home Plug power line communication (PLC) standard. DOT enable QCA needs to be set high to enable power for the QCA.

Note: the **QCA7005** is not rated for use at the operating temperatures the module will see while vehicle is running and needs to be **kept off when not in charging mode**. The QCA7005 can be used safely for charging while the vehicle is at rest.

It is important that the QCA chip should only be turned on when the EV is connected to the off-board charger (EVSE) and be turned off again after EVSE is disconnected from the EV. OpenECU platform provides a Simulink API to control the QCA chip power from the application software in Simulink.

Note: Before turning the QCA chip off after a charging session, it is important to:

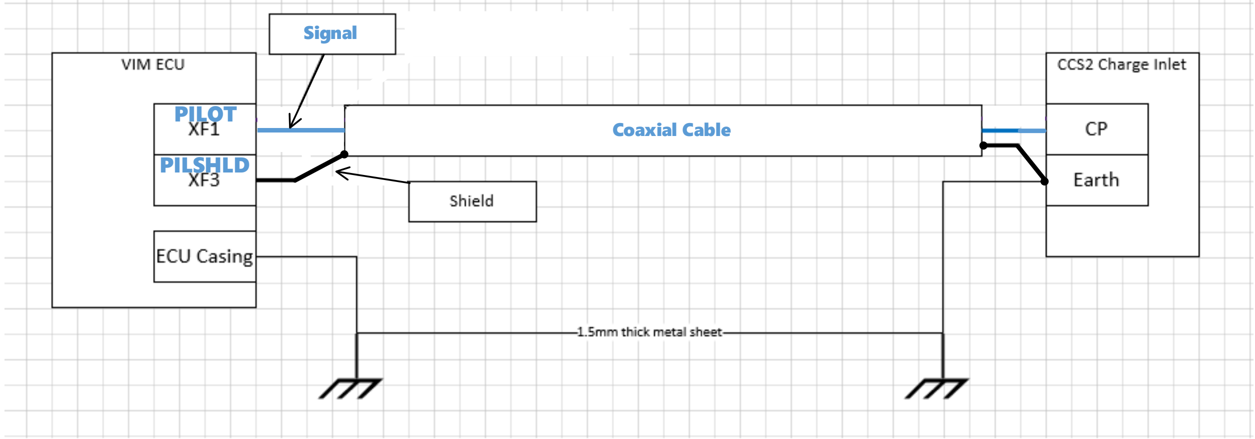
1. Terminate the TCP link to the EVSE and wait for confirmation from OpenECU platform that the TCP link is indeed terminated (A dedicated OpenECU Simulink API is available for this purpose).
2. Turn off QCA chip only after 30s or more is passed since TCP link is terminated. This delay will give enough time for the QCA chip to update its attached NVM before it is turned off.

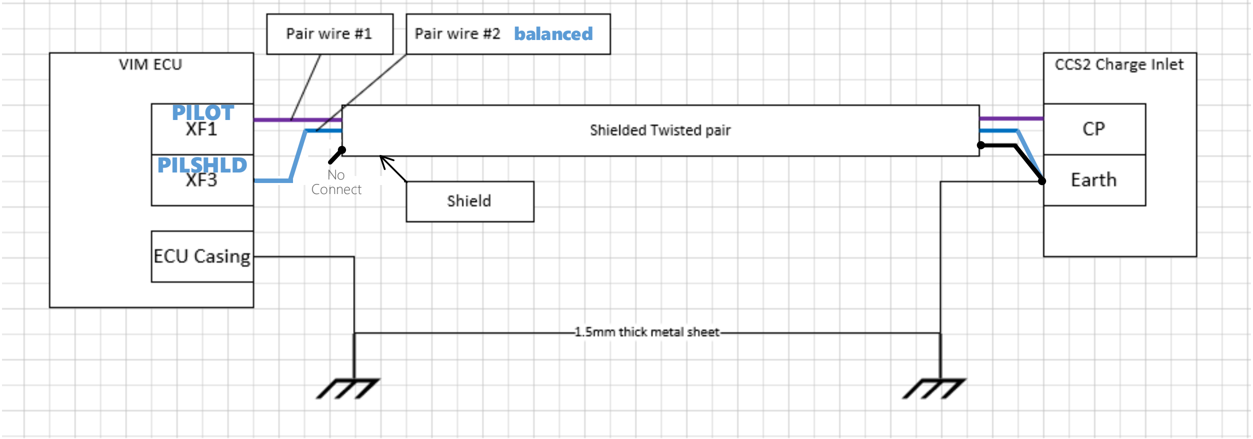
If the above process is not followed there could be corruption in the NVM memory of the QCA chip, which could put the QCA chip in an unrecoverable state.

For the J1772 interface, the proximity signal input is on pin XE1 and pilot signal input is on pin XF1. Pilot shield is connected to XF3.

The Pilot signal can be connected by either a coaxial cable or by shielded twisted pair. If shielded twisted pair is used, the PE pin from the charge inlet should be connected to both the shield and the twisted wire to be connected to XF3.

Figure. Powerline communication shielding





If the EVSE supports high-level communication over the CP line, according to DIN SPEC 70121:2014-12, then the application software must first set the "DOT enable QCA" and "DOT enable (pin XD4+YA1+YA4+YB1+YC2+YC3+YD1+YD2+YD3+YB4+YE1+YE2+YK3+ZA4+ZB4+ZE1+ZE2+ZF3 / serial)" digital outputs to enable the QCA7005 chip. The "PLC Interface Chip Status (internal)" channel can be monitored with a digital input to determine when the QCA7005 is ready for communication.

After the QCA7005 is ready for communication, the connection process is started by calling the pv2g_Connection block with the "initiate" inport set to 1 or pv2g_initiate_connection() C-API function. This will start the Signal Level Attenuation Characterization (SLAC) connection process. Details of the exchange of messages during this process can be found in the DIN SPEC 70121. The status of the connection process can be monitored with the following channels using the pdd_DataInput block or pdd_data_input() C-API function.

Channel	**Description**
V2G connection error code	Error code encountered during the V2G connection process, including SLAC, SDP, and TCP/IP Values: 0 - Set if everything progressed as expected 1 - Set if the QCA initialization failed 2 - Set if the CM_SLAC_PARM.REQ message failed to transmit 3 - Set if the CM_SLAC_PARM.CNF message was not received within the timeout period 4 - Set if the CM_SLAC_PARM.CNF message was received with invalid data 5 - Set if the CM_START_ATTEN_CHAR.IND message failed to transmit 6 - Set if the CM_MNBC_SOUND.IND message failed to transmit 7 - Set if the CM_ATTEN_CHAR.IND message was not received within the timeout period 8 - Set if the CM_ATTEN_CHAR.IND message was received with invalid data 9 - Set if the CM_ATTEN_CHAR.IND message was received with attenuation too high 10 - Set if the CM_ATTEN_CHAR.RSP message failed to transmit 11 - Set if the CM_SLAC_MATCH.REQ message failed to transmit 12 - Set if the CM_SLAC_MATCH.CNF message was not received within the timeout period 13 - Set if the CM_SLAC_MATCH.CNF message was received with invalid data 14 - Set if the CM_SET_KEY.REQ message failed to transmit 15 - Set if the CM_SET_KEY.CNF message was not received within the timeout period

Channel	**Description**
	16 - Set if the CM_SET_KEY.CNF message was received with invalid data 17 - Set if the link was not established within the timeout 18 - Set if the SDP request failed to transmit 19 - Set if an error was encountered during the SDP response 20 - Set if the TCP/IP connection request failed to transmit 21 - Set if an error was encountered during the TCP/IP response 22 - Set if the TCP/IP connection was terminated by the server
V2G connection status	An enum indicating the V2G connection status Values: 0 - connection is inactive 1 - connection is in progress 2 - connection has failed 3 - connection has succeeded
V2G QCA7005 error code	Last error code encountered by the QCA7005 device Values: 0 - Set if there is no error 1 - Set if the signature register is bad 2 - Set if the write buffer was incorrect during initialization 3 - Set if the read buffer has overflowed 4 - Set if the write buffer has overflowed 5 - Set if the driver did not detect the CPU on status when expected 6 - Set if the driver received a CPU on status when not expected 7 - Set if the interrupt enable register was incorrectly set 8 - Set if the read buffer register was incorrect 9 - Set if the write buffer register was incorrect 10 - Set if the driver encountered a software error
V2G SLAC EVSE avg attenuation	Average attenuation received from EVSE during SLAC

Channel	Description
	Values: Attenuation in dB relative to -50 dB. Positive values denote increasing attenuation. (e.g. 20dB reported by this channel is equivalent to -70dB absolute attenuation)
TCP Status	Status of the TCP/IP connection Values: 0 - Connection disconnected 1 - SDP request waiting 2 - SDP response received 3 - TCP/IP ready to connect 4 - TCP/IP connecting 5 - TCP/IP connected Note: This status is the same as the "tcp_status" outport of the pv2g_Connection block
PLC Link Status	Status of the HomePlug AVLN link Values: 0 - No link 1 - Link Note: This status is the same as the "link_status" outport of the pv2g_Connection block
PLC Interface Chip Status	Status of the QCA7005 chip Values: 0 - Not ready for communication 1 - Ready for communication

After initiating a connection with the pv2g_Connection block, the "V2G connection status" channel can be monitored for the connection status. If the connection has failed (2), then the "V2G connection error code" can be used to determine the cause of the failure. If the connection succeeds (3), then further communication can continue using the pv2g_Message block. When the connection succeeds (i.e. "V2G connection status" is set to 3), this is the equivalent of "PLC Link Status" set to 1, and "TCP Status" set to 5.

After all communication is complete, the connection can be terminated by setting the “terminate” inport of the pv2g_Connection block, which will shutdown the TCP/IP connection with the EVSE.