DESIGN SPECIFIC GUIDE

Solar Configuration

For Installers

qcells

Purpose

The Q.HOME SMART platform can be installed in different configurations based on the customer's needs. This document provides application specific guidance on designing a Solar Configuration system; specifically meaning a system which consists of AC Module(s) and a Combiner Box, without a battery or backup unit.

This document includes definitions of terms, some single line diagrams, descriptions of system components and other important application specific information related to the installation and commissioning process of the Q.HOME SMART Solar Configuration.

Table of Contents

1 Compatible Products and Applications

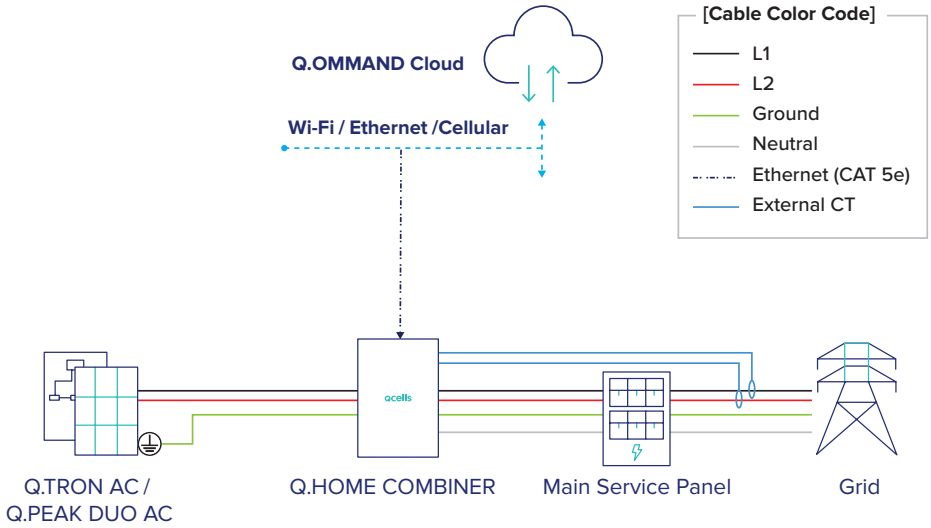
The Q.HOME SMART Solar Configuration consists of three system products with mandatory/optional components.

System products	 AC Module (Q.TRON BLK M-G2.XY+/AC, Q.PEAK DUO BLK ML-G10.XY+/AC)*	▪ Microinverter pre-attached on the backside of the module with DC cables connected ▪ Maximizes energy production by using a sophisticated maximum power point tracking (MPPT) algorithm
	 AC Combiner (Q.HOME COMBINER 80 G1)	▪ Combines up to four AC branch circuits of Q.TRON AC/Q.PEAK DUO AC modules ▪ Communicates with the microinverters over the AC power line enabling module level monitoring ▪ Enables remote control/monitoring from the Q.OMMAND app/web by internet connection via Ethernet, Wi-Fi or cellular ▪ Provides revenue grade production metering and non-revenue grade consumption metering ▪ Various power control features to meet customers' needs and regional utilities' requirements
	 Commissioning App (Q.OMMAND PRO)	▪ Mobile application for commissioning and remote support ▪ Checks error codes during installation and operation ▪ Maps AC module array and matches serial numbers to modules ▪ Used to manage project sites with Qcells products
Components	Mandatory/Optional Components	▪ AC cable and cable connection kits ▪ Current transformers – Consumption CTs (2 provided) – External Production CT (optional) ▪ Off-the-shelf OCPDs needed for branch circuits in the device, as well as upstream of the combiner (installed in MSP). ▪ Cellular Modem (optional)

* Q.TRON BLK M-G2.XY+/AC and Q.PEAK DUO BLK ML-G10.XY+/AC solar modules, where "X" can be any letter between A to W and "Y" can be any number between 1 to 9.

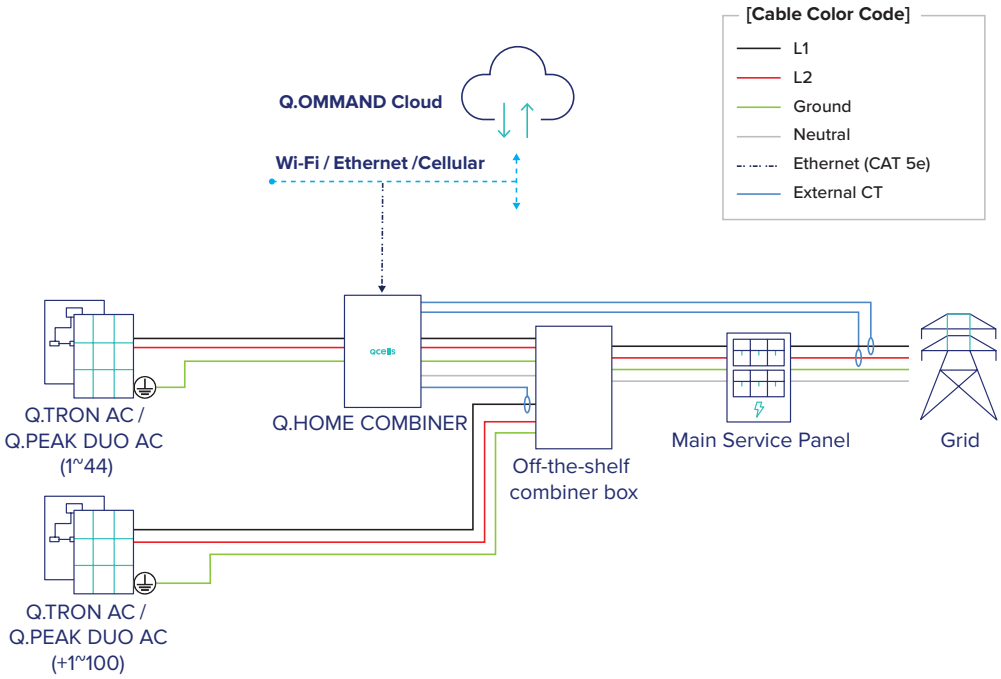
2 System Overview

2.1 Basic System



The basic Solar Configuration system consists of one Q.HOME COMBINER and up to 44 Q.TRON AC/Q.PEAK DUO AC Modules.

2.2 Expanded System



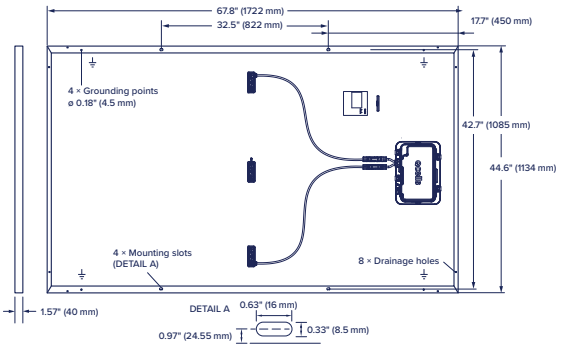
The expanded Solar Configuration system consists of one Q.HOME COMBINER and over 44 Q.TRON AC/Q.PEAK DUO AC modules. In this case, up to 44 Q.TRON AC/Q.PEAK DUO AC modules can be accommodated by the Q.HOME COMBINER (as in the basic system above). Up to 100 additional Q.TRON AC/Q.PEAK DUO AC modules can be connected to an off-the-shelf combiner box. All Q.TRON AC/Q.PEAK DUO AC modules communicate with the gateway in the Q.HOME COMBINER, enabling remote monitoring and control in the cloud. The off-the-shelf combiner box is a non-Qcells product purchased separately.

3 Technical Specification

3.1 Q.TRON AC

Mechanical Specification

Format	67.8 in × 44.6 in × 1.57 in (including frame) (1722 mm × 1134 mm × 40 mm)
Weight	50.6 lbs (23 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed ARC solar glass
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 18 monocrystalline Q.ANTUM NEO solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in× 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 25.8 in (655 mm), (−) ≥ 25.2 in (640 mm)
Connector	Stäubli MC4; IP68



AC Output Electrical Characteristics

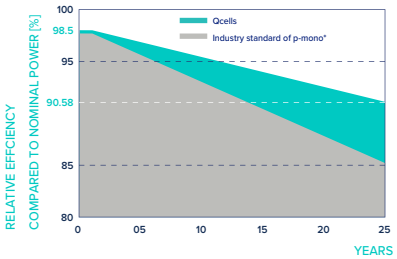
Q.MI.349B-G1 (Model Name)					
Peak Output Power	[VA]	366	**Power Factor (adjustable)**		0.85 leading...0.85 lagging
Max Continuous Output Power	[VA]	349	**Max. number of AC Modules per Q.HOME COMBINER 80 G1**	[ea]	44 (Q.HOME COMBINER CB : Max 4)
Nominal (L-L) Voltage / Range	[V]	240 / 211 to 264	**Max Units per 20 A (L-L) Branch Circuit**	[ea]	11
Nominal Rated Output Current	[A]	1.45	**Total Harmonic Distortion**	[%]	<5
Nominal Frequency / Range	[Hz]	60 / 59.3 to 60.5	**Overvoltage Class AC Port**		III
Extended Frequency Range	[Hz]	50 to 66	**Night-Time Power Consumption**	[mW]	60
Power Factor at Rated Power		1.0	**CEC Efficiency**	[%]	97

Electrical Characteristics

POWER CLASS				415	420	425	430	435	440
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC1 (POWER TOLERANCE +5 W / −0 W)									
Minimum	**Power at MPP**[1]	P_{MPP}	[W]	415	420	425	430	435	440
	Short Circuit Current[1]	I_{SC}	[A]	13.49	13.58	13.66	13.74	13.82	13.90
	Open Circuit Voltage[1]	V_{OC}	[V]	38.47	38.75	39.03	39.32	39.60	39.88
	Current at MPP	I_{MPP}	[A]	12.83	12.91	12.98	13.05	13.13	13.20
	Voltage at MPP	V_{MPP}	[V]	32.34	32.54	32.74	32.94	33.14	33.33
	Efficiency[1]	η	[%]	≥21.3	≥21.5	≥21.8	≥22.0	≥22.3	≥22.5
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]									
Minimum	**Power at MPP**	P_{MPP}	[W]	313.7	317.5	321.2	325.0	328.8	332.6
	Short Circuit Current	I_{SC}	[A]	10.87	10.94	11.00	11.07	11.14	11.20
	Open Circuit Voltage	V_{OC}	[V]	36.50	36.77	37.04	37.31	37.58	37.84
	Current at MPP	I_{MPP}	[A]	10.10	10.15	10.21	10.27	10.33	10.38
	Voltage at MPP	V_{MPP}	[V]	31.07	31.26	31.46	31.65	31.84	32.03

[1]Measurement tolerances P_{MPP} ±3 %; I_{SC}; V_{OC} ±5 % at STC: 1000 W/m², 25 ± 2 °C, AM 1.5 according to IEC 60904-3 • [2]800 W/m², NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY

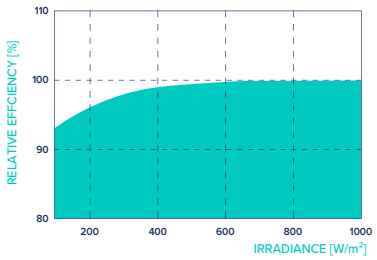


*Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

At least 98.5 % of nominal power during first year. Thereafter max. 0.33 % degradation per year. At least 95.53 % of nominal power up to 10 years. At least 90.58 % of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS							
Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.24
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.30	Nominal Module Operating Temperature	NMOT	[°F]	109±5.4 (43±3°C)

Properties for System Design

Maximum System Voltage	V_{SYS}	[V]	1000 (UL)	PV Module Classification	Class II
Maximum Series Fuse Rating		[A DC]	25	Fire Rating Based on ANSI/UL 61730	C / TYPE 2
Max. Design Load, Push/Pull[3]		[lbs/ft²]	113 (5400 Pa)/75 (3600 Pa)	Permitted Module Temperature on Continuous Duty[2]	−40°F up to +140°F (−40°C up to +60°C)
Max. Test Load, Push/Pull[3]		[lbs/ft²]	169 (8100 Pa)/113 (5400 Pa)	Storage Temperature Range[2]	−40°F up to +140°F (−40°C up to +60°C)

[2] According to the Q.MI.349B-G1, the maximum temperature is stated as "60 °C (+140 °F)", but the maximum temperature of the connected DC module is up to "+85 °C (+185 °F)".

[3] See Installation Manual

Qualifications and Certificates

Base DC module (Q.TRON BLK M-G2(.XY)+/AC solar module series, where "X" can be any letter between A to W and "Y" can be any number between 1 to 9.)

UL 61730-1 & UL 61730-2, CE-compliant;
Quality Controlled PV -TÜV Rheinland;
IEC 61215:2016;
IEC 61730:2016.
This data sheet complies
with DIN EN 50380.

Qcells Microinverter (Q.MI.349B-G1 (Model Name))

This product is UL listed as PV Rapid Shut Down Equipment
UL1741, UL 1741SA, UL 1741SB, CSA C22.2 No 107

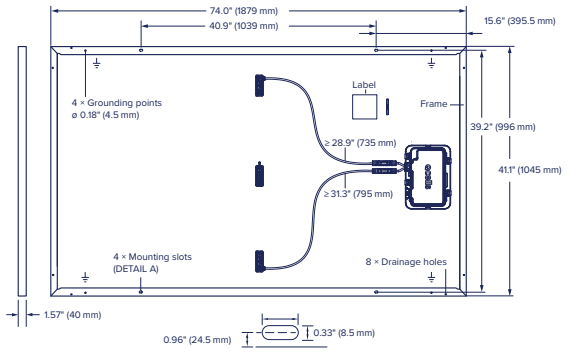
AC Module (Q.TRON BLK M-G2(.XY)+/AC solar module series, where "X" can be any letter between A to W and "Y" can be any number between 1 to 9.

UL 1741, CSA C22.2 No. 107, IEEE E1547.

3.2 Q.PEAK DUO AC

Mechanical Specification

Format	74.0 in × 41.1 in × 1.57 in (including frame) (1879 mm × 1045 mm × 40 mm)
Weight	52.36 lbs (23.75 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed ARC solar glass
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in× 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 31.3 in (795 mm), (−) ≥ 28.9 in (735 mm)
Connector	Stäubli MC4; IP68



AC Output Electrical Characteristics

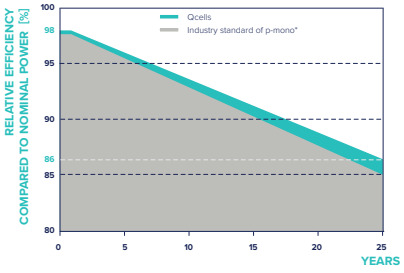
Q.MI.349B-G1 (Model Name)					
Peak Output Power	[VA]	366	**Power Factor (adjustable)**		0.85 leading...0.85 lagging
Max Continuous Output Power	[VA]	349	**Max. number of AC Modules per Q.HOME COMBINER 80 G1**	[ea]	44 (Q.HOME COMBINER CB : Max 4)
Nominal (L-L) Voltage / Range	[V]	240 / 211 to 264	**Max Units per 20 A (L-L) Branch Circuit**	[ea]	11
Nominal Rated Output Current	[A]	1.45	**Total Harmonic Distortion**	[%]	<5
Nominal Frequency / Range	[Hz]	60 / 59.3 to 60.5	**Overvoltage Class AC Port**		III
Extended Frequency Range	[Hz]	50 to 66	**Night-Time Power Consumption**	[mW]	60
Power Factor at Rated Power		1.0	**CEC Efficiency**	[%]	97

DC Power Electrical Characteristics

POWER CLASS				395	400	405	410	415
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC1 (POWER TOLERANCE +5 W / −0 W)								
Minimum	**Power at MPP[1]**	P_{MPP}	[W]	395	400	405	410	415
	Short Circuit Current[1]	I_{SC}	[A]	11.10	11.14	11.17	11.20	11.23
	Open Circuit Voltage[1]	V_{OC}	[V]	45.27	45.30	45.34	45.37	45.41
	Current at MPP	I_{MPP}	[A]	10.71	10.77	10.83	10.89	10.95
	Voltage at MPP	V_{MPP}	[V]	36.88	37.13	37.39	37.64	37.89
	Efficiency[1]	η	[%]	≥ 20.1	≥ 20.4	≥ 20.6	≥ 20.9	≥ 21.1
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT2								
Minimum	**Power at MPP**	P_{MPP}	[W]	296.3	300.1	303.8	307.6	311.3
	Short Circuit Current	I_{SC}	[A]	8.95	8.97	9.00	9.03	9.05
	Open Circuit Voltage	V_{OC}	[V]	42.69	42.72	42.76	42.79	42.83
	Current at MPP	I_{MPP}	[A]	8.46	8.51	8.57	8.62	8.68
	Voltage at MPP	V_{MPP}	[V]	35.03	35.25	35.46	35.68	35.89

1 Measurement tolerances P_{MPP} ±3 %; I_{SC}; V_{OC} ±5 % at STC: 1000 W/m2, 25±2 °C, AM 1.5 according to IEC 60904-3 • [2]800 W/m2, NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY

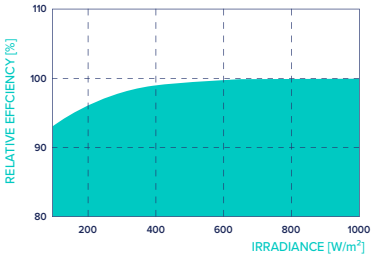


At least 98 % of nominal DC power during first year. Thereafter max. 0.5 % degradation per year. At least 93.5 % of nominal DC power up to 10 years. At least 86 % of nominal DC power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organization of your respective country.

*Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS							
Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.34	Nominal Module Operating Temperature	NMOT	[°F]	109±5.4 (43±3°C)

Properties for System Design

Maximum System Voltage	V_{SYS}	[V]	1000 (UL)	PV Module Classification	Class II
Maximum Series Fuse Rating		[A DC]	20	Fire Rating Based on ANSI/UL 61730	C/TYPE 2
Max. Design Load, Push/Pull[3]		[lbs/ft²]	75 (3600 Pa)/75 (3600 Pa)	Permitted Module Temperature on Continuous Duty[2]	−40°F up to +140°F (−40°C up to +60°C)
Max. Test Load, Push/Pull[3]		[lbs/ft²]	113 (5400 Pa)/113 (5400 Pa)	Storage Temperature Range[2]	−4°F up to +113°F (−20°C up to +45°C)

[2] According to the Q.MI.349B-G1, the maximum temperature is stated as "+140°F (60°C)", but the maximum temperature of the connected DC module is up to "+185°F (+85°C)".

[3] See Installation Manual

Qualifications and Certificates

Base DC module (Q.PEAK DUO BLK ML-G10.XY+ solar module series, where "X" can be any letter between A to W and "Y" can be any number between 1 to 9.)

UL 61730-1 & UL 61730-2, CE-compliant;
IEC 61215:2016;
IEC 61730:2016.
This data sheet complies
with DIN EN 50380.

Qcells Microinverter (Q.MI.349B-G1)

This product is UL listed as PV Rapid Shut Down Equipment
UL1741, UL 1741SA, UL 1741SB, CSA C22.2 No 107.

AC Module (Q.PEAK DUO BLK ML-G10.XY+/AC solar module series, where "X" can be any letter between A to W and "Y" can be any number between 1 to 9.)

UL 1741, CSA C22.2 No. 107, IEEE E1547.

3.3 Q.HOME COMBINER

GENERAL PRODUCT INFORMATION		Q.HOME COMBINER 80 G1
Manufacturer		Hanwha Solutions Corporation
Product Warranty		5 years
Country of Manufacture		Vietnam
ACCESSORIES AND REPLACEMENT PARTS		
Supported AC Modules (Microinverter included)		Q.TRON BLK M-G2.XY+/AC, Q.PEAK DUO BLK ML-G10.XY+/AC *
Cellular Modem (CELLULAR-MT-MODEM-CAT4-TN5)		4G based LTE-CAT4 (+5year data plan included)
WiFi Dongle (WIFI-HQ-DG-USB)		FCC Part 15 Subpart C / 2412.0 to 2462.0 MHz ***
Circuit Breakers		Supports Eaton BR210, BR215 **, BR220, BR230, BR240, BR250, and BR260 circuit breakers
Consumption Monitoring CT (CT-JS-CLAMP-200A-5.2m)		A pair of 200 A clamp type current transformers (accuracy ±0.5 %) ***
* Q.TRON BLK M-G2.XY+/AC and Q.PEAK DUO BLK ML-G10.XY+/AC solar modules, where "X" can be any letter between A to W and "Y" can be any number between 1 to 9. ** pre-assembled / *** included in the package (Others are not included, need to be ordered seperately)		
ELECTRICAL SPECIFICATIONS		
System Voltage	[V]	120 / 240 VAC, 60 Hz
Eaton BR Series Busbar Rating	[A]	125
Max. Continuous Current Rating (input from PV / storage)	[A]	64
Branch Circuits (Solar or Solar + Storage)	[pcs]	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. Total Branch Circuit Breaker Rating (input)	[A]	80 A of distributed generation / 95 A with Gateway breaker included
Gateway Circuit Breaker	[A]	15 A rating Eaton BR215 included
Consumption Monitoring	[A]	Metering with a pair of 200 A split core current transformers (accuracy ±2.0 %)
Production Metering	[A]	Metering with 200 A solid core current transformer pre-wired to Gateway (accuracy ±0.5 %)
MECHANICAL DATA		
Max. AC Module Connection Q'ty	[pcs]	▪ Up to 44 AC Modules in 1 combiner (11 in series × 4 strings) ▪ Up to 144 AC Modules using 1 combiner with external subpanel
Dimensions (W × H × D)	[inch]	14.6 × 19.3 × 6.3 / height is 21.7 with mounting brackets (37.0 × 49.0 × 16.0 cm / height is 55.1 cm with mounting brackets)
Weights (without connection cables)	[lb]	11.5 (5.2 kg)
Operating Temperature Range	[°F]	−40 to 140 (−40 to 60 °C)
Storage Temperature Range	[°F]	−40 to 140 (−40 to 60 °C)
Enclosure Environmental Rating		Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire Sizes		▪ 20 A breaker inputs: 12 to 8 AWG copper conductors ▪ Main lug combined output: 10 to 2/0 AWG copper conductors ▪ Neutral and ground: 8 to 6 copper conductors ▪ Always follow local code requirements for conductor sizing
Cooling		Natural convection
Altitude	[m]	Up to 2,000 (6,561 feet)
INTERNET CONNECTION OPTIONS		
Wi-Fi		IEEE 802.11b/g/n
Cellular		CELLMODEM-CAT4 (4G based LTE-CAT4)
Ethernet		Optional, IEEE 802.3, CAT5E (or CAT6) UTP Ethernet cable
COMPLIANCE		
AC Combiner		▪ UL 1741, CSA C22.2 No.107 ▪ FCC Part 15.B ▪ ANSI C 12.20 accuracy class 0.5 (production meter) ▪ NEMA type 3R ▪ IEEE 2030.5 / CSIP Compliant
Monitoring board		UL 61010-1 / UL 61010-2-030 CSA 22.2 No. 61010-1-12 / CSA 22.2 No. 61010-2-030
CT sensor		Solid core, Split core XOBA

▪ Qualifications and Certificates

4 Single Line Diagrams

In the Solar Configuration, Q.TRON AC / Q.PEAK DUO AC Modules are connected to the Q.HOME COMBINER, which combines the AC modules into a single output. The main lines which are L1, L2, Ground and Neutral of the Q.HOME COMBINER are connected to the main service panel (MSP). The Gateway found inside the Q.HOME COMBINER communicates over the AC power line with the microinverters on the modules. There are 4 single line diagrams below based on different locations of the consumption CTs.

Note

Due to bi-directional energy flow, consumption metering has specific polarity to define whether the power is importing or exporting. The consumption CTs should be installed appropriately according to the direction indication label attached on the edge of the clamp CTs. Please refer to image in "7.5 Consumption CT Wiring" on page 20.

4.1 Measuring Grid Interconnection Point

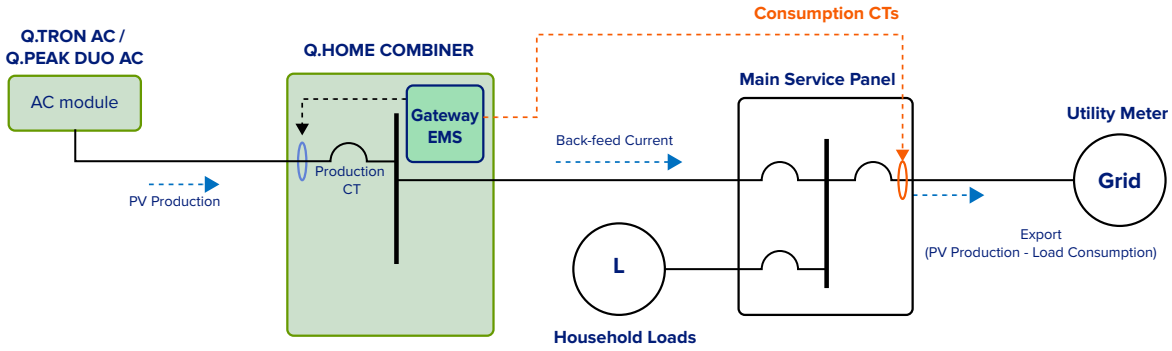


Figure 1. Solar & Load measurement (Consumption CTs are installed in MSP at service entrance)

The consumption CTs are installed at the grid interconnection point. Installing the CTs at the service entrance is required at sites where power control settings are necessary.

Note

Installation according to this single line diagram is mandatory for PCS certified features. Refer to 6. Power Control Features for further details.

4.2 Measuring Household Loads

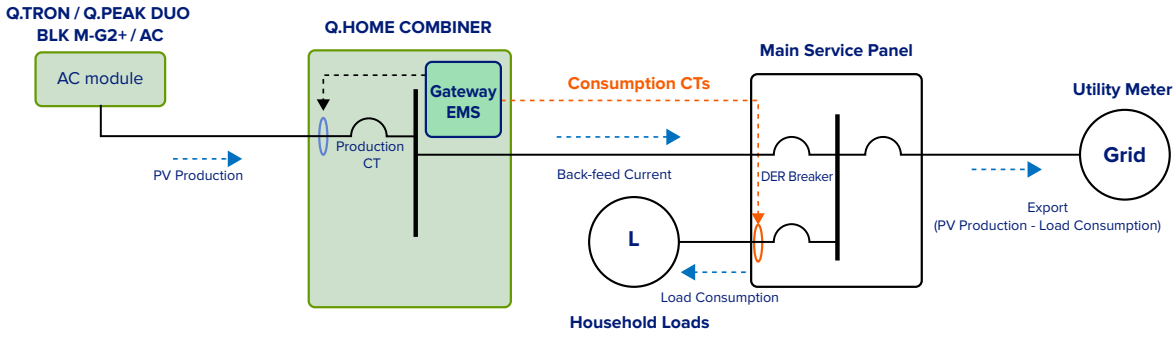


Figure 2. Load only measurement (Consumption CTs are installed in MSP on Household branches)

The consumption CTs are clamped on and measure household loads only. The CTs can be installed at this location in case it's difficult to install them at the service entrance. Make sure the cables of household loads are all clamped in the CTs. If not, the monitoring data in Q.OMMAND will not be accurate.
In case a pair of consumption CTs can't clamp on all the branches of household loads, 2 pairs of CTs can be installed in parallel. The gateway will sum the measured values and show the total consumption data in Q.OMMAND.

4.3 No Consumption Metering

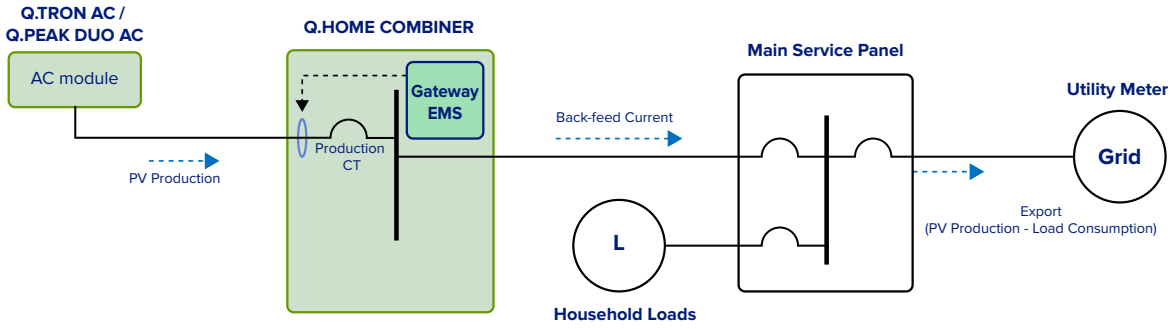


Figure 3. Consumption CTs not installed

In case the customer is not willing to monitor the consumption data nor requires any power control settings, the consumption CTs may not be installed. Monitoring energy flow and setting operation modes in Q.OMMAND PRO/HOME will be limited.

4.4 Expanded System with External Production CT

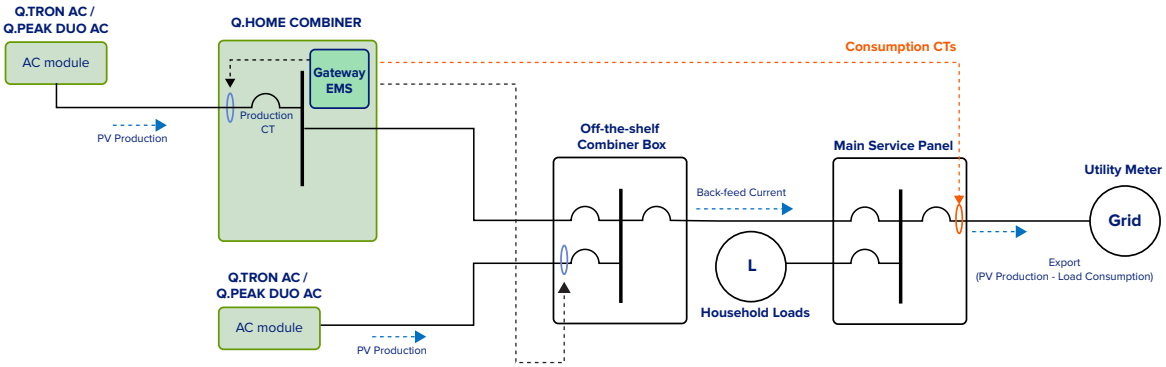


Figure 4. External Production CT installed in Off-the-shelf combiner box

An external production CT is required to be installed in the off-the-shelf combiner box as a solution for the expanded system (>44 AC Modules). The consumption CTs can be installed at the grid interconnection point, household loads, or not installed at all according to customer needs and site environment. However, it is strongly recommended to be installed at the grid interconnection point as shown in Figure 4. The Q.HOME COMBINER and off-the-shelf combiner box should be installed close to each other to secure the accuracy level of production metering. The external production CT (wire leads :2 m, 20 AWG) is provided by Qcells as an optional accessory.

5 Balance of System Components

Below is a high-level list of materials used in the Solar Configuration. Some of these items are not included with the system products and may need to be purchased separately as optional accessories. This list does not cover additional items such as tools, conduits or other components that are not provided by Qcells. For a complete list of tools, wires and other installation requirements, please refer to the installation manual.

Q.HOME COMBINER 80 G1 Installation Manual, available here.

Q.TRON AC / Q.PEAK DUO AC Installation Manual, available here.

5.1 System Products

Category	Quantity Per Site	Product Name	Description
System Product	Site Specific	Q.TRON BLK M-G2.XY+/AC, Q.PEAK DUO BLK ML-G10. XY+/AC *	AC Module with pre-assembled microinverter
	1	Q.HOME COMBINER 80 G1	Combines four strings of AC modules into a single output

* Q.TRON BLK M-G2.XY+/AC and Q.PEAK DUO BLK ML-G10.XY+/AC solar modules, where “X” can be any letter between A to W and “Y” can be any number between 1 to 9.

5.2 Components and Accessories

Category	Quantity Per Site	Product Name	Description	Component of Q.HOME COMBINER 80 G1
AC Cable	Site Specific	CAS-HQ-LO-1000	Long cable with AC connector at the end for modules in landscape orientation (L=1000 mm)	
		CAS-HQ-LO-1300		
		CAS-HQ-SH-650	Long cable with AC connector at the end for modules in portrait orientation (L=650 mm)	
		CAS-HQ-SH-800		
Cable Connection Kit	User Specific	CAB-HQ-KIT-200	Long cable without AC connector at the end for the free design of PV installation (L=200 m)	
		CON-HQ-KIT-20	Connectors used to assemble the AC cable (200 m) by installer themselves ▪ Package: 20 pcs Female + 20 pcs Male	
		ECAP-HQ-KIT-20	End-cap used to terminate the end of a string of PV modules ▪ Package: 20 pcs Female + 20 pcs Male	
Unlocking Tool	User Specific	UNT-HQ-TOOL-1	Unlocking tool	
Metering	1	Production CT	A 200 A revenue grade solid core production CT pre-wired to Gateway (18 AWG)	O
	2	CT-JS-CLAMP-200A-5.2m	A pair of 200 A slim clamp type consumption CTs with ±0.5 % accuracy (5.2 m, 20 AWG)	O
	Site Specific	CT-HQ-SOLID-200A-2m	A 200 A revenue grade solid core production CT for larger PV system (>44 AC Modules / 2 m, 18 AWG)	
		CT-JS-CLAMP-200A-25m	A 200A slim clamp type consumption CT with ±0.5 % accuracy with long cables (25 m, 20 AWG)	
Communication	1	WIFI-HQ-DG-USB	Wi-Fi dongle with 2.4 GHz bandwidth	O
	1	CELLULAR-MT-MODEM-CAT4-TN5	4G based cellular modem with 5 year data plan included	
Off-the-shelf BOS (Not provided by Qcells)	Site Specific	Circuit Breaker (EATON BR Series)	Circuit breakers for PV branch circuit(s) in Q.HOME COMBINER BR210 ~ BR260 compatible only	
	1	Off-the-Shelf Combiner Box	A solar sub-panel to combiner all the AC Modules into a single string for larger PV system (>44 AC Modules)	

6 Power Control Features

This system is equipped with a power control system (PCS). All PCS controlled busbars or conductors shall be protected with suitably rated overcurrent devices appropriately sized for the busbar rating or conductor ampacity.

Note

The maximum operating currents in controlled busbars or conductors are limited by the settings of the power control system and may be lower than the sum of the currents of the connected controlled power sources.

Only qualified personnel shall be permitted to set or change the setting of the maximum operating current of the PCS. The maximum PCS operating current setting shall not exceed the busbar rating or conductor ampacity of any PCS controlled busbar or conductor.

6.1 PEL (Power Export Limit)

Feed-in Limit / Limit Export

This feature controls the power exported from the MSP to the grid to meet requirements from regional utilities. Real-time measurements of PV production and load consumption controls the output generated from the PV system, ensuring that the power exported to the grid never exceeds the power limit set by the installer during commissioning. When the allowed level of power export is set to “zero”, it is called a export limit (non-export) system. Consumption CTs are mandatory for this feature, and must be installed and set properly for accurate operation.

Note

The consumption CTs must be installed at the grid interconnection point.

6.2 Back-Feed Limit

This feature controls the current backfeed from the Q.HOME COMBINER into the MSP, enabling installers to design larger PV systems without performing a main service upgrade. The NEC (National Electric Code, NFPA 70), limits the capacity of any distributed energy resource [DER] (generally meaning PV or Energy Storage System) such that the combined rating of the main service and DER's breakers do not exceed 120% of the service's rating. This can severely limit the size of a DER system which can be installed, and potentially necessitate a Main Panel Upgrade [MPU], or downsizing of the main service breaker.

Qcells' power control system allows installers to set the limit on the backfeed current from the PV system to the MSP, enabling installers and homeowners to avoid the time and cost of an MPU. This function will effectively establish the new "nameplate rating" of the completed system, assuming the current value selected is less than the combined rating of the connected AC Modules.

※ NEC (National Electric Code) 2020 705.12

Backfeed allowed ≤ ((120 % of busbar rating) - Main Service Breaker [MSP] rating) / 125 %.

Ex) MSP Busbar rating 200 A, Main Circuit Breaker 200 A
: ((200 A × 120 %) - 200 A) / 125 % = **32 A**

6.3 BBOC (Busbar Overload Control)

This feature controls the power by monitoring the combined currents of PV and grid imports to ensure the busbar remains within safe limits. The NEC (National Electric Code, NFPA 70), limits the continuous output current rating of PCS to not exceed 125 % of the DER's breaker rating. Real-time measurements of PV production and load consumption limits the output generated from the PV system when the current flowing through the busbar in the MSP exceeds its capacity. Consumption CTs are mandatory for this feature, and must be installed and set properly for accurate operation. This effectively allows a PV system of any size to be installed, regardless of the rating of the service, MSP busbar, or MSB.

※ NEC (National Electric Code) 2020 705.13

DER’s Breaker ≥ 125 % of the continuous output current rating of PCS

Note

The consumption CTs must be installed at the grid interconnection point.

If the total capacity of branch circuit breakers in the MSP(Main Service Panel) exceeds the panel’s busbar rating, the MSB(Main Service Breaker) must be installed to protect the panel and work with the BBOC function for safe overload protection. Without the MSB, the total capacity of branch circuit breakers must not exceed the busbar rating.

6.4 Ratings

PCS Modes	PCS Device	Max Rating for 44 AC modules	PCS Export Range
BBOC (Busbar Overload Control)	Q.TRON BLK M-G2.XY+/AC, Q.PEAK DUO BLK ML-G10.XY+/AC * (w/Q.MI.349B-G1 (model name))	64 A / 15.36 kVA	64 A to 0 A
PEL (Power Export Limit)	Q.TRON BLK M-G2.XY+/AC, Q.PEAK DUO BLK ML-G10.XY+/AC * (w/Q.MI.349B-G1 (model name))	64A / 15.36 kVA	15,360 W to 0 W

* Q.TRON BLK M-G2.XY+/AC and Q.PEAK DUO BLK ML-G10.XY+/AC solar modules, where “X” can be any letter between A to W and “Y” can be any number between 1 to 9.

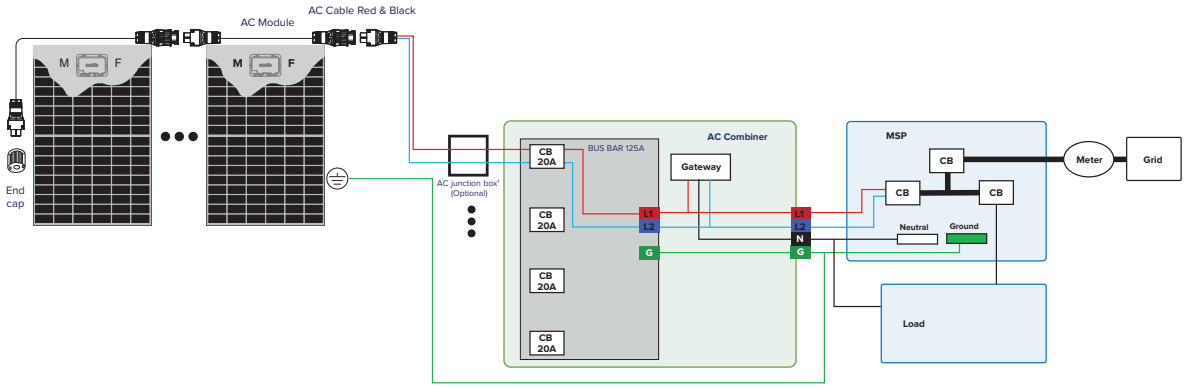
7 System Installation Considerations

7.1 PV Rapid Shutdown Equipment (PVRSE)

The AC module and AC combiner products are UL listed as PV Rapid Shutdown Equipment, and collectively make a PV Rapid Shutdown System (PVRSS); conforming to the requirements of NEC (NFPA 70) section 690.12.

Any other equipment installed in or on this PV system may adversely affect the operation of the PVRSS. It is the responsibility of the installer to ensure that the completed PV system meets all rapid shut down requirements.

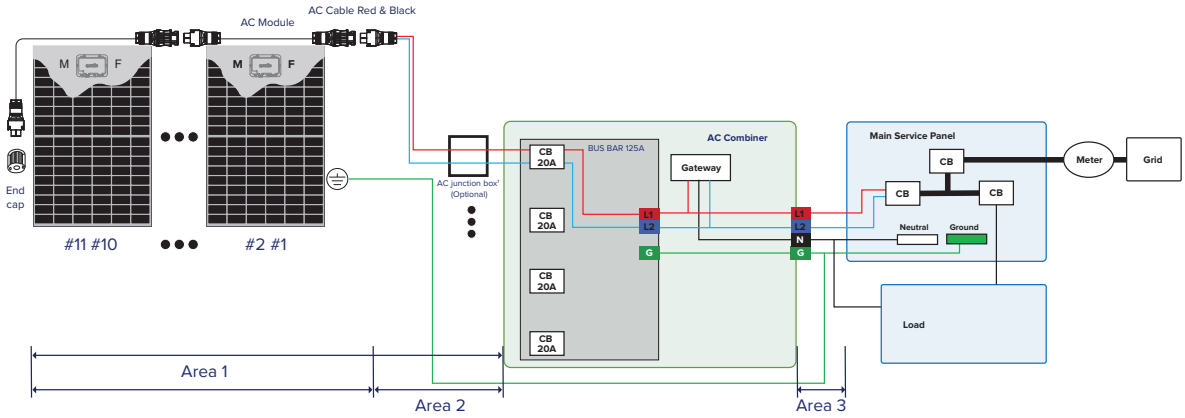
7.2 Solar Configuration Field Wiring Diagram



- Ground the AC modules according to local requirements.
  ※ Qcells AC modules have integrated ground and double insulation, so no GEC (grounding electrode conductors) or EGC (equipment grounding conductors) are required.
- AC junction box is optional and voluntarily determined to be installed based on installer decision. (optional)
- The Q.TRON AC/Q.PEAK DUO AC module uses a two-wire system and does not have neutral connection. However, the Q.HOME COMBINER still requires a neutral connection from the main service panel.

7.3 AC Cable and Voltage Rise

AC system configuration with Q.TRON AC/Q.PEAK DUO AC Module (w/Q.MI.349B-G1 (model name))



Area	Description
1	Voltage rise of the Qcells AC Cable to the rooftop junction box (or back to the Combiner if ran using the AC raw cable). See the VRise tables for Qcells AC Cable and Qcells AC Raw Cable as applicable.
2	Voltage rise from a rooftop junction box to the AC Combiner. See the VRise of Conductor lengths by wire section tables.
3	Voltage rise from the AC Combiner (or PV subpanel) to the MSP. See the VRise of Conductor lengths by wire section tables.

Calculate and verify that the total voltage rise is less than 2 %. The following sections provide formulas and tables needed to determine the expected voltage rise. Additional losses (at terminals, circuit breakers, etc.) should be minimal and can be ignored.

Calculating Total Voltage Rise

1. Qcells AC Cable

The Qcells AC Cable is a continuous length of 12 AWG stranded copper, outdoor-rated cable, with integrated connectors for the Q.TRON AC/Q.PEAK DUO AC Module (w/Q.MI.349B-G1 (model name)). The following table provides the associated lengths of AC Cables.

Voltage type and conductor count	Item	PV module orientation	Length
240 VAC, two conductors	CAS-HQ-SH-650	Portrait	1.3 m (4.2 ft)
240 VAC, two conductors	CAS-HQ-SH-800	Portrait	1.6 m (5.2 ft)
240 VAC, two conductors	CAS-HQ-LO-1000	Portrait, Landscape	2.0 m (6.5 ft)
240 VAC, two conductors	CAS-HQ-LO-1300	Portrait, Landscape	2.6 m (8.5 ft)

2. Voltage rise formula

All resistances of the system components are in series and are cumulative. Since the same current flows through each resistance, the total VRise is the total current times the total resistance.

The VRise percentage for an AC system is :

% of Total VRise = % VRise Area 1 + % VRise Area 2 + % VRise Area 3

% VRise Area 1 = % by number of Microinverters in Internal VRise of AC Cable longest string
= [$\sum_{1}^{n}$ {(amps/inverter x number of inverters) x (Ω/ft x 2−way wire length)" }] ÷ 240 VAC × 100

"n" is number of Microinverters for longest string

% VRise Area 2 = VRise Section 2 ÷ 240 VAC × 100
= (amps/inverter × number of inverters) × (Ω/ft × 2-way wire length of Area 2)

"number of inverters" is the total number of inverters in longest string connected to the Q.HOME COMBINER

% VRise Area 3 = VRise Section 3 ÷ 240 VAC × 100
= (amps/inverter × number of inverters) × (Ω/ft × 2-way wire length of Area 3)

"number of inverters" is the total number of inverters in longest string connected to the Q.HOME COMBINER

3. VRise of Qcells AC Cable

Use the following tables to determine the voltage rise attributed to the AC Cable.
Reference the module orientation and AC Cable length to select values from the appropriate table.

Qcells AC Cable Vrise (CAS-HQ-SH-650 for Portrait Orientation)											
	1	2	3	4	5	6	7	8	9	10	11
Current [A]	1.45	2.91	4.37	5.82	7.28	8.73	10.18	11.64	13.09	14.55	16.00
Vrise [V]	0.02	0.07	0.14	0.24	0.36	0.51	0.68	0.88	1.10	1.35	1.62
Vrise [%]	0.01	0.03	0.06	0.10	0.15	0.21	0.28	0.37	0.46	0.56	0.68

Qcells AC Cable Vrise (CAS-HQ-SH-800 for Portrait Orientation)											
	1	2	3	4	5	6	7	8	9	10	11
Current [A]	1.45	2.91	4.36	5.82	7.27	8.73	10.18	11.63	13.09	14.54	16.00
Vrise [V]	0.03	0.09	0.18	0.30	0.45	0.64	0.85	1.09	1.36	1.66	2.00
Vrise [%]	0.01	0.04	0.08	0.13	0.19	0.26	0.35	0.45	0.57	0.69	0.83

Qcells AC Cable Vrise (CAS-HQ-SH-1000 for Landscape Orientation)											
	1	2	3	4	5	6	7	8	9	10	11
Current [A]	1.45	2.91	4.37	5.82	7.28	8.73	10.18	11.64	13.09	14.55	16.00
Vrise [V]	0.04	0.12	0.23	0.38	0.57	0.80	1.06	1.36	1.70	2.08	2.50
Vrise [%]	0.02	0.05	0.10	0.16	0.24	0.33	0.44	0.57	0.71	0.87	1.04

Qcells AC Cable Vrise (CAS-HQ-SH-1300 for Landscape Orientation)											
	1	2	3	4	5	6	7	8	9	10	11
Current [A]	1.45	2.91	4.36	5.82	7.27	8.73	10.18	11.63	13.09	14.54	16.00
Vrise [V]	0.05	0.15	0.29	0.49	0.74	1.03	1.38	1.77	2.21	2.70	3.24
Vrise [%]	0.02	0.06	0.12	0.20	0.31	0.43	0.57	0.74	0.92	1.13	1.35

VRise of Qcells AC Raw Cable Lengths

When using Qcells AC Raw Cable (CAB-HQ-KIT-200), reference the count of Q.TRON AC/Q.PEAK DUO AC Module (w/Q.MI.349B-G1 (model name)) MIs and the cable length to on the following table to find the voltage rise for this section.

feet	Q.TRON AC/Q.PEAK DUO AC Module (w/Q.MI.349B-G1 (model name)) per string										
	1	2	3	4	5	6	7	8	9	10	11
10	0.02	0.05	0.07	0.10	0.12	0.14	0.17	0.19	0.22	0.24	0.26
15	0.04	0.07	0.11	0.14	0.18	0.22	0.25	0.29	0.32	0.36	0.40
25	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54	0.60	0.66
40	0.10	0.19	0.29	0.38	0.48	0.58	0.67	0.77	0.86	0.96	1.06
60	0.14	0.29	0.43	0.58	0.72	0.86	1.01	1.15	1.30	1.44	1.58
80	0.19	0.38	0.58	0.77	0.96	1.15	1.34	1.54	1.73	1.92	2.11
100	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.92	2.16	2.4	2.64

VRise of Conductor lengths by wire section

Use the following table to help determine the proper wire size based on the number of Q.TRON AC/Q.PEAK DUO AC Module (w/Q.MI.349B-G1 (model name)) MIs in the circuit, and the length of the wire section.

- When determining the VRise in Area1, use the MI count of the longest string.
- When determining the VRise in Area 2 (homerun lines), use the MI count of the longest string.
- When determining the VRise in Area 3, used the combined MI Count (inclusive of all strings).

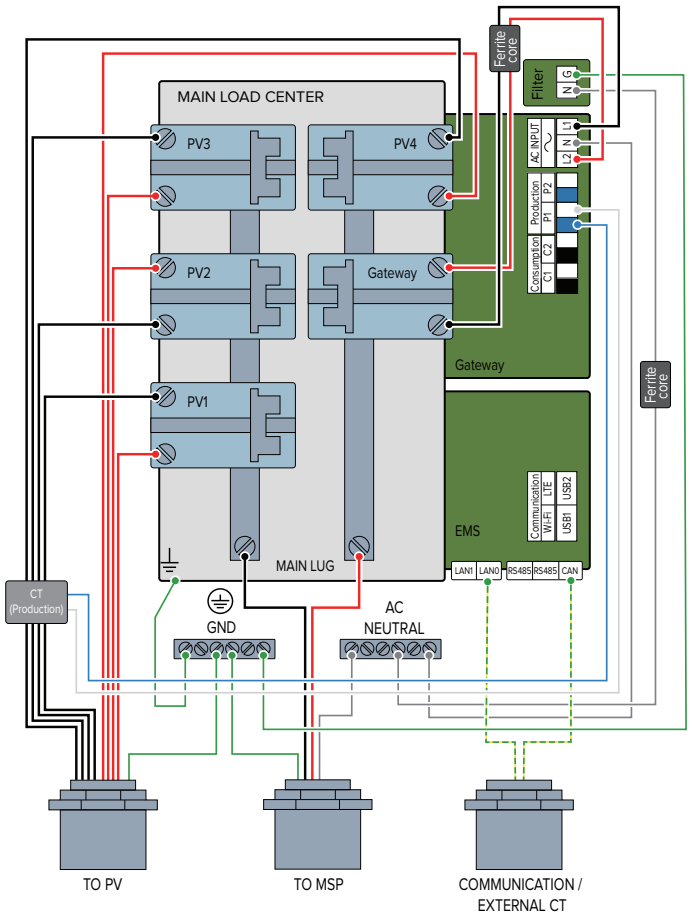
The tables list the maximum length (ft) a particular conductor can be run to maintain 1% voltage rise for this section of wire. Keep in mind that if multiple sections are combined, then the conductor size should be increased appropriately.

	Number of Q.TRON AC/Q.PEAK DUO AC Module (w/Q.MI.349B-G1 (model name))														
AWG	3	6	9	11	14	17	20	23	26	29	32	35	38	41	44
	Max length to maintain ≤1% Vrise (ft)														
12	139	70	46	38	30	24	21	18	16	14	13	12	11	10	9.5
10	222	111	74	61	48	39	33	29	25	23	21	19	17	16	15
8	354	177	117	97	76	63	53	46	41	36	33	30	28	26	25
6	562	281	187	153	120	99	84	73	65	58	53	48	44	41	38
4	895	448	298	244	192	158	134	116	103	92	84	76	70	65	61
3	1125	563	375	307	241	198	165	146	130	116	105	96	89	82	77
2	1420	711	474	388	304	251	213	185	164	147	133	122	112	104	97
1	1790	896	597	488	384	316	268	233	206	185	167	153	141	131	122

7.4 Q.HOME COMBINER Wiring Diagram

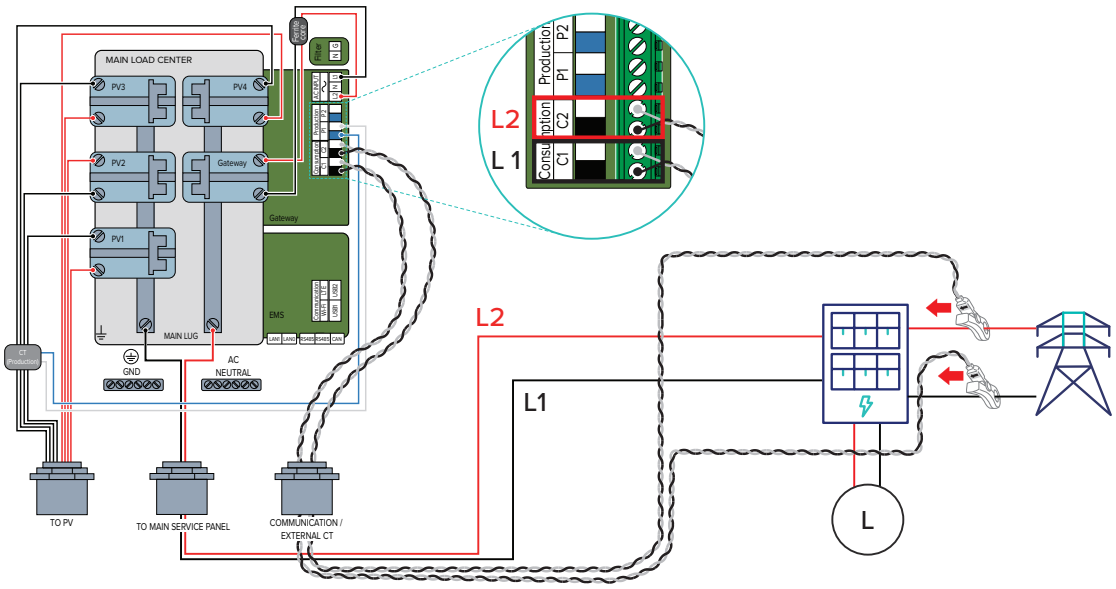
Cable Coding Chart

	L1
	L2
	GND
	Neutral
	Positive (Production CT) Positive (Consumption CT)
	Negative (CT)
	Optional Comm. Channels

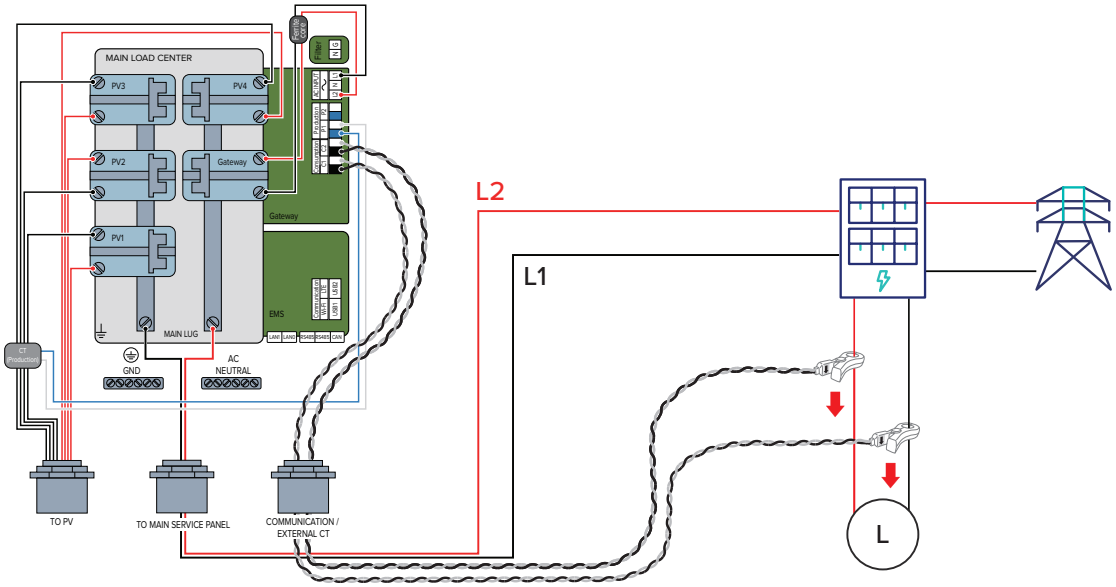


7.5 Consumption CT Wiring

Grid (PV + Load) side Installation

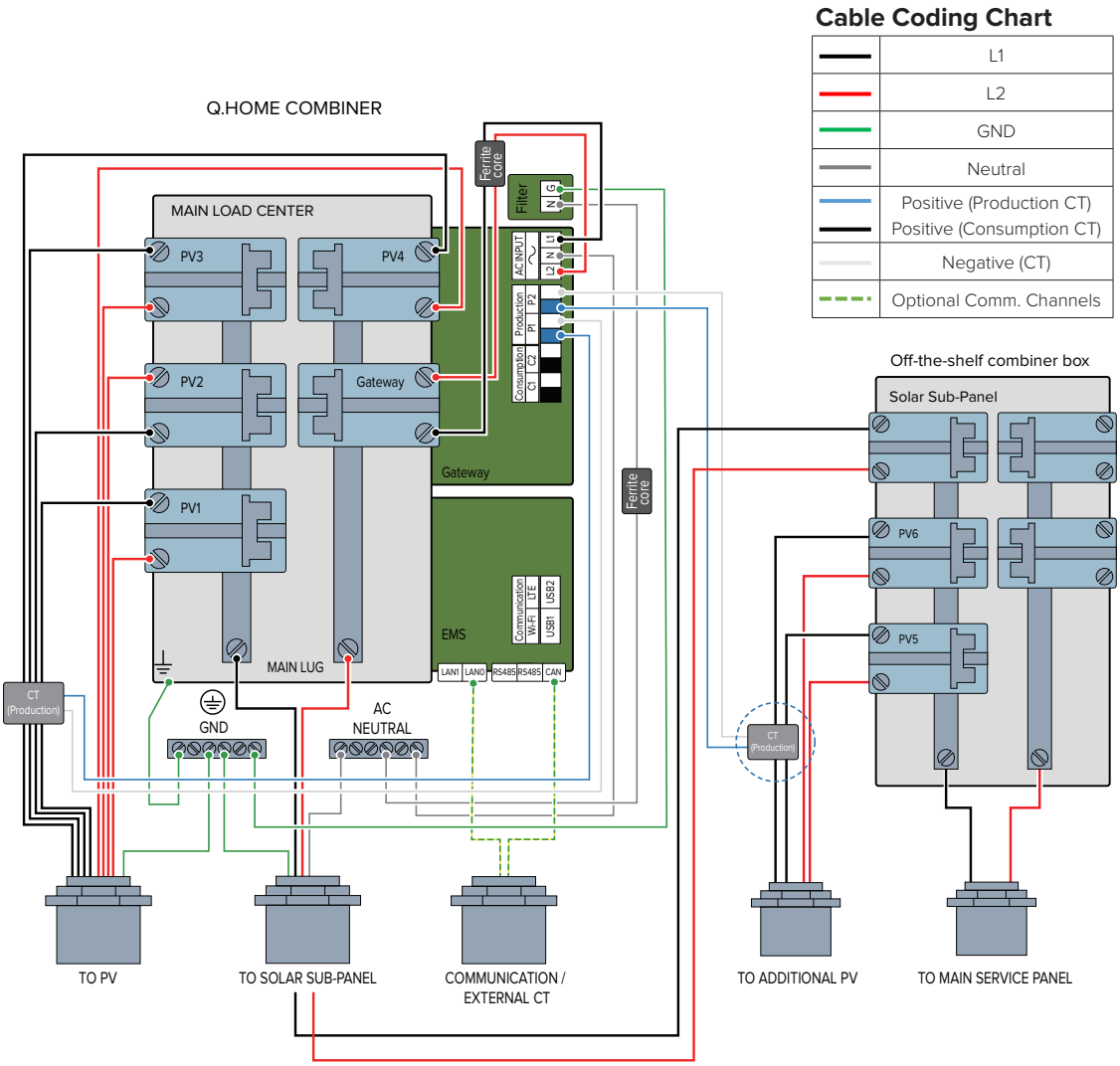


Load side Only Installation

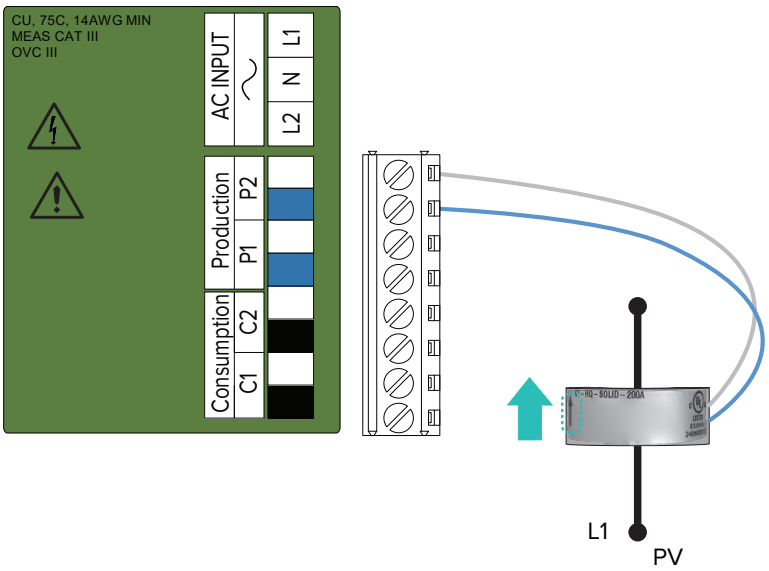


Due to bi-directional energy flow, consumption metering has specific polarity to define whether the power is importing or exporting. The consumption CTs should be installed appropriately according to the direction indication label attached on the edge of the clamp CTs. The red arrow represents the marking on the consumption CTs. Although both the Grid (PV + Load) side and the Load side are acceptable, we recommend using the Grid (PV + Load) side.

7.6 External Production CT Wiring for Expanded System (>44 AC Modules)

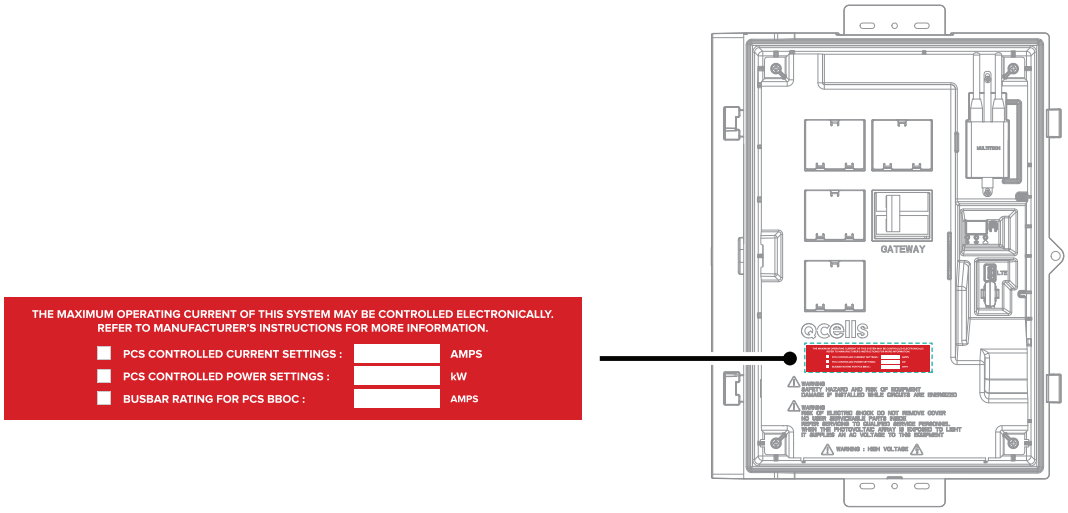


External production CT wiring on GEM Board (Gateway)

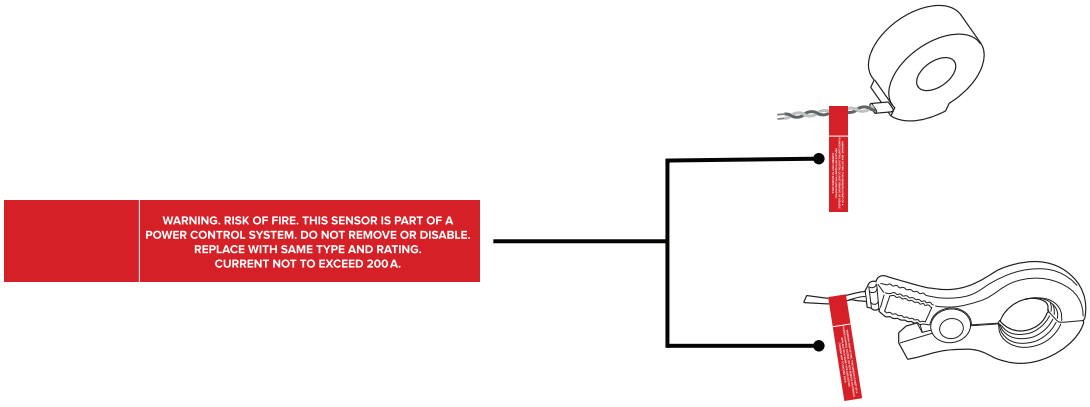


7.7 PCS Labels

For site where the system output is limited by the Qcells PCS, a label indicating the configured PCS mode must be attached to the Q.HOME COMBINER. Mark the left white box according to the configured PCS mode. Record the current or power setting value in the right white blank. Apply this label on the Q.HOME COMBINER deadfront at the recommended position shown in the image below. This label is provided as a component of the Q.HOME COMBINER.



Q.HOME COMBINER also provides PCS labels for current transformers. Apply these labels to the current transformers that enable the PCS modes. Align the white line on the label with the wires near the conductor of the current transformer, then fold the left side and attach it.



8 System Commissioning Considerations

8.1 Q.OMMAND PRO App

To commission the product via mobile, search and install the Q.OMMAND PRO app by scanning the QR code below. You can also download the app by clicking the Apple App Store or Google Play Store.

Android

iOS

8.2 Q.OMMAND PRO Web

To monitor via computer web-browser, visit: us.qommand.qcells.com

Note
If you do not yet have an account, you will need to register as an installer and create an account prior to commissioning the system via Q.OMMAND PRO.

8.3 Q.OMMAND PRO Manual

Scan the QR code below or click here to access the Q.OMMAND PRO manual.

Q.OMMAND PRO Manual

MEMO

MEMO

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