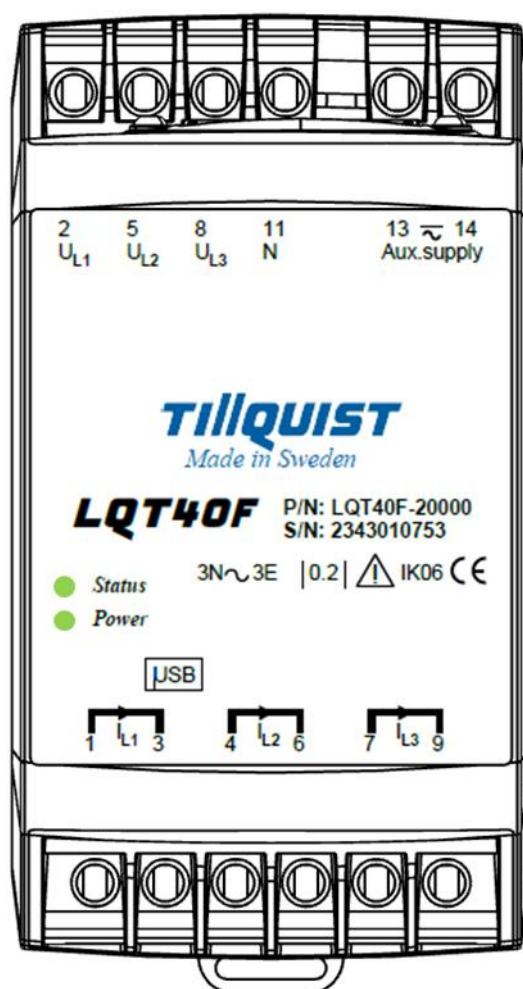




USER MANUAL LQT40F



TILLQUIST GROUP AB

Box 1120
SE-164 22 Kista
Sweden
Tel: +46 8 594 632 00
info@tillquist.com
www.tillquist.com

The LQT40F is a programmable multi-transducer designed for accurate and flexible measurement of AC current and voltage in modern power systems. With its True RMS measurement capability, it reliably monitors everything from basic single-phase installations to advanced 4-wire unbalanced loads.

In addition to general power monitoring, the LQT40F is particularly well-suited for applications requiring high-precision frequency measurement, such as turbine control and other demanding industrial processes where stability and accuracy are critical.

Equipped with serial communication via Profibus, Profinet or EtherNet/IP, the LQT40F offers seamless integration into control, protection, and monitoring environments. Its compact format and the free configuration software ConfigLQT ensure simple installation, programming, and customization via the integrated USB port.

This manual is intended for engineers, technicians, and system integrators. It provides guidance on installation, configuration, operation, and troubleshooting. Please read the safety instructions carefully before installation.

Important User Information

Disclaimer

The information in this document is for informational purposes only. Please inform Tillquist of any inaccuracies or omissions found in this document.

Tillquist disclaims any responsibility or liability for any errors that may appear in this document. Tillquist reserves the right to modify its products in line with its policy of continuous product development. The information in this document shall therefore not be construed as a commitment on the part of Tillquist and is subject to change without notice. Tillquist makes no commitment to update or keep current the information in this document.

The data, examples and illustrations found in this document are included for illustrative purposes and are only intended to help improve understanding of the functionality and handling of the product. In view of the wide range of possible applications of the product, and because of the many variables and requirements associated with any particular implementation, Tillquist cannot assume responsibility or liability for actual use based on the data, examples or illustrations included in this document nor for any damages incurred during installation of the product. Those responsible for the use of the product must acquire sufficient knowledge in order to ensure that the product is used correctly in their specific application and that the application meets all performance and safety requirements including any applicable laws, regulations, codes and standards. Further, Tillquist will under no circumstances assume liability or responsibility for any problems that may arise as a result from the use of undocumented features or functional side effects found outside the documented scope of the product. The effects caused by any direct or indirect use of such aspects of the product are undefined and may include e.g. compatibility issues and stability issues.

Copyright © 2025 Tillquist

Contact Information

Postal address:

Box 1120

164 22 Kista, Sweden

E-Mail: info@tillquist.com

Table of contents

1	Instructions	4
1.1	Purpose of this document	4
1.2	Intended use	4
1.3	Mounting	4
1.4	Installation and maintenance	4
1.4.1	Safety notes	4
1.5	Operation	5
1.6	Safety	5
1.7	Warning!	5
1.8	Maintenance	5
1.9	Symbols	6
2	Connections	7
2.1	Connection diagram	7
2.2	Electric connection	8
2.3	8	
2.4	Connection diagrams – System connection	8
3	Measuring	11
3.1	Measured quantities	11
3.2	Measuring system	12
3.2.1	Phase-Locked loop - PLL	12
3.2.2	Soft mode	12
3.2.3	Block diagram	12
3.2.4	Frequency filter	12
4	Output – Profibus/Profinet	13
4.1	Process Data Set Mapping	13
4.2	Profibus	13
4.3	Profinet and EtherNet/IP	14
5	Commissioning	15
5.1	Programming of the transducer	15
5.2	USB configuration interface	15
5.3	LED functionality	15
6	Technical Data	16
7	Ordering Codes	17

1 Instructions

1.1 Purpose of this document

This document describes how to use the LQT40F multi transducer. The user manual is intended to be used by:

- installation personnel and commissioning engineers
- service and maintenance personnel
- planners

1.2 Intended use

The transducer is intended to measure electrical quantities, 1 to 3-phases (alternating voltage and currents). The measured electrical quantities are then available via different serial interface, depending of versions.

1.3 Mounting

	The transducer shall be installed into a protecting cabinet on a 35 mm top hat rail (DIN rail) according IEC 60715. The enclosure shall not be accessible without tools.
	Ensure at least 5 mm free space is left around the device on the DIN rail to allow proper ventilation and safe operation.

1.4 Installation and maintenance

The installation, operation and maintenance shall only be made by qualified electrical engineering personnel and in accordance with applicable regulations. Before the installation, please check that the transducer is the correct type and complies with the installation needs.

1.4.1 Safety notes

	Attention: Danger to life! Ensure that all leads are free of potential when connection them!
	The AUX supply must be protected by an external fuse or circuit breaker with a maximum rating of 10 A. In addition, an external disconnect device (circuit breaker or switch) shall be installed close to the equipment, easily accessible to the operator, and with its OFF position clearly marked.
	Voltage measurements (U_{L1} , U_{L2} , U_{L3}) inputs must have circuit breaker or fuses rated 10 Amps or less.
	No fuses should be used on the currents inputs (I_{L1} , I_{L2} , I_{L3}). The current measuring circuits from the current transformers must be short-circuited before disconnection.
	When UL certification is required, use a UL-listed current transformer with the correct transformation ratio to ensure compliance with UL standards. a) "Always open or disconnect circuit from power-distribution system (or service) of building before installing or servicing current transformers". b) "The current transformers may not be installed in equipment where they exceed 75 percent of the wiring space of any cross-sectional area within the equipment".

	c) "Restrict installation of current transformer in an area where it would block ventilation openings". d) "Restrict installation of current transformer in an area of breaker arc venting". e) "Not suitable for Class 2 wiring methods" and "Not intended for connection to Class 2 equipment". f) "Secure current transformer and route conductors so that the conductors do not directly contact live terminals or bus". g) The word "WARNING" and the following or equivalent statement: "To reduce the risk of electric shock, always open or disconnect circuit from power-distribution system (or service) or building before installing or servicing current transformers".
--	---

1.5 Operation

The transducer is intended for operation at an altitude not exceeding 2000 m and in an environment that is not considered as wet location.

Operation temperature: -10...22...24...+55°C

Proper function is only guaranteed if the USB is not connected to the transducer and all the instructions in this manual are followed for safety reasons.

If the equipment is used in a manner not specified by this instruction, the protection provided by the equipment may be impaired.

1.6 Safety

All inputs and outputs are galvanically isolated from each other.

Protection class:	II, protective insulation, voltage inputs via protective impedance.
Communication interfaces:	Only connect the communication interfaces of the device to circuits with extra-low voltage (max. 30VAC, 42.4V peak, 60VDC). Only connect the communication interfaces of the device to circuits which provide double or reinforced insulation to mains or other hazardous voltages.
Protection:	IP40 (housing), IP20 (terminals)

1.7 Warning!

	Connection must comply with current regulations for systems with rated voltage up to 1000 V. Before switching on or off and if the housing is removed, all voltages to the equipment must be switched off and external currents circuit shorted before disconnected.
---	--

1.8 Maintenance

The transducer requires no maintenance. Any repairs shall be performed by trained personnel authorized by the product's manufacturer only, or the equipment shall be returned to the supplier for repair.

Wipe the device using a clean, dry and soft cloth if necessary. Do not use solvents.

1.9 Symbols



Warning for life-threatening or hazardous for properties situations.
Indicates situations where careful reading of this manual is required to avoid potential HAZARD situations.



Caution, possibility of electric shock



Read the manual before use



The device must be discarded in a professional way

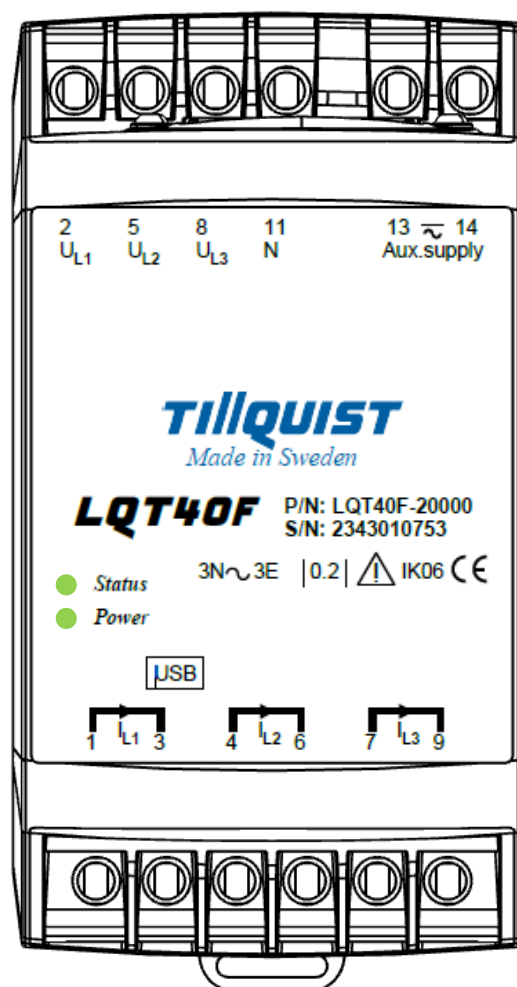


CE conformity mark

2 Connections

2.1 Connection diagram

Voltage input		
U_{L1}	2	
U_{L2}	5	
U_{L3}	8	
N	11	
Current input	In	Out
I_{L1}	1	3
I_{L2}	4	6
I_{L3}	7	9
Aux Power Supply		
	13	
	14	



2.2 Electric connection

The plug-in terminals needs to be removed before accessing the input terminals.

Inputs L1, L2, L3, N, I1, I2, I3, Aux.supply	
Wire section:	6.0 mm ² / 10 AWG solid and stranded copper ≥70 °C
Clamp opening size:	3.2 × 3.9 mm
Wire stripping:	max 9 mm
Recommended torque:	0.8 - 0.88 Nm / 7.2 - 7.9 in.lbs

2.3

2.4 Connection diagrams – System connection

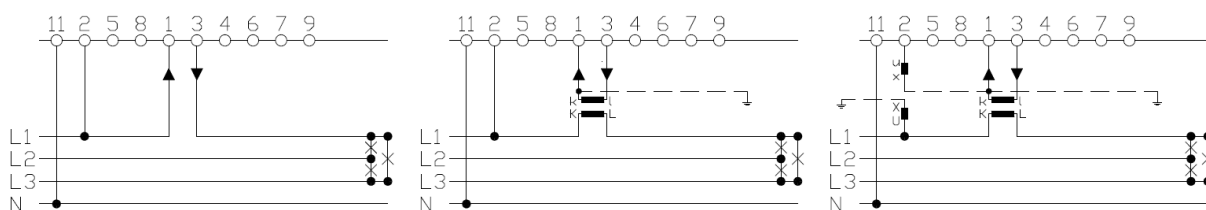
LQT40F system connection is programmable from single phase to 4-wire balanced or unbalanced connection.

Configurable System Connection											
System connection	Application	I1	I2	I3	U1	U2	U3	N	U12	U23	U31
-00	4wire, 3 phase symmetric load	X	-	-	X	-	-	X	-	-	-
-01	1-wire, 1 phase	X	-	-	X	-	-	X	-	-	-
-02	3-wire, 3 phase symmetric load	X	-	-	-	-	-	-	X	-	-
-03	3-wire, 3 phase symmetric load	X	-	-	-	-	-	-	-	X	-
-04	3-wire, 3 phase symmetric load	X	-	-	-	-	-	-	-	-	X
-05	3-wire, 3 phase symmetric load	X	-	-	X	X	X	-	X	X	X
-09	3-wire, 3 phase asymmetric load	X	-	X	X	X	X	-	X	X	X
-11	4-wire, 3 phase asymmetric load	X	X	X	X	X	X	X	X	X	X
-11	4-wire, 3 phase asymmetric load Open Delta	X	X	X	X	X	X	-	X	X	X

-00

1-phase
1 element

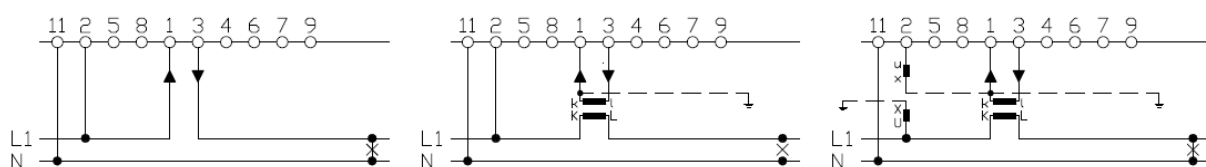
4-wire
3-phase symmetric load



-01

1-phase
1 element

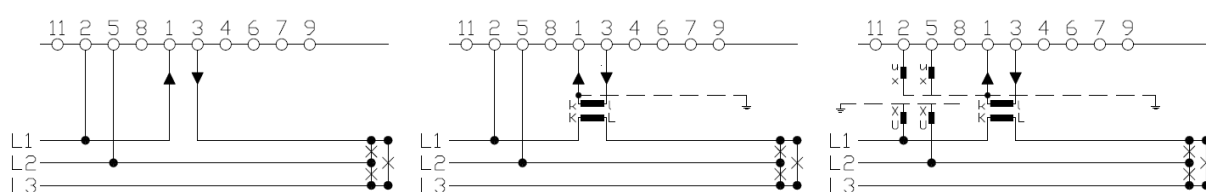
2-wire
Single-phase AC



-02

1-phase
1 element

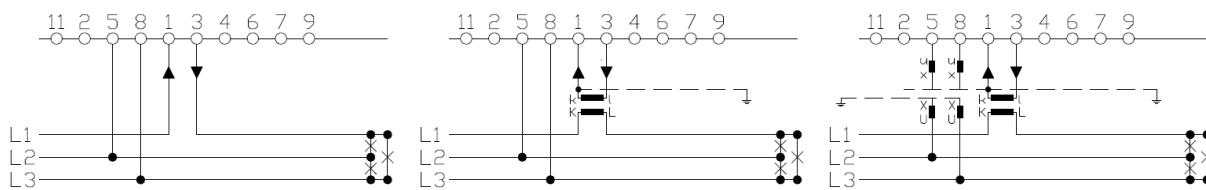
3-wire
3-phase symmetric load phase-shift U12-I1



-03

1-phase
1 element

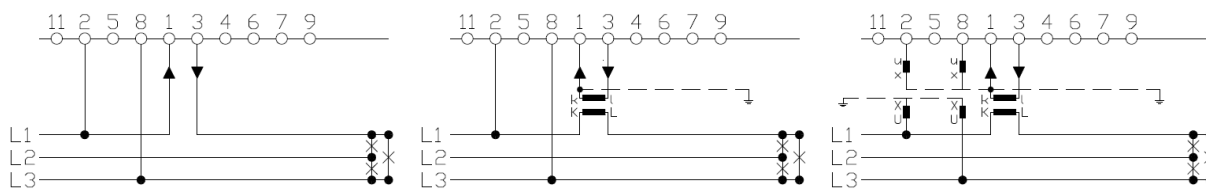
3-wire
3-phase symmetric load phase-shift U23-I1



-04

1-phase
1 element

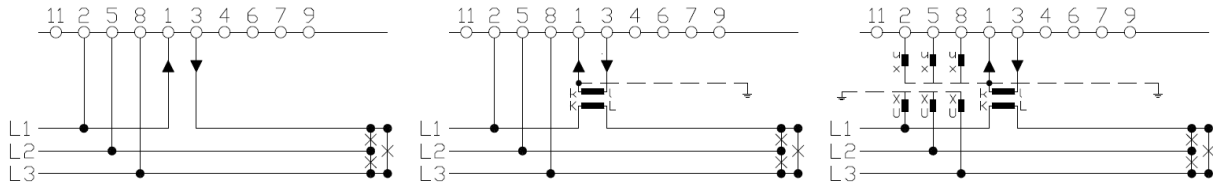
3-wire
3-phase symmetric load phase-shift U31-I1



-05

3-phase
1 element

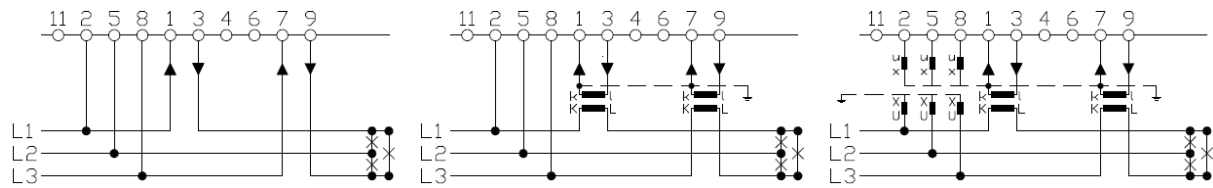
3-wire
3-phase symmetrical load



-09

3-phase
2 elements

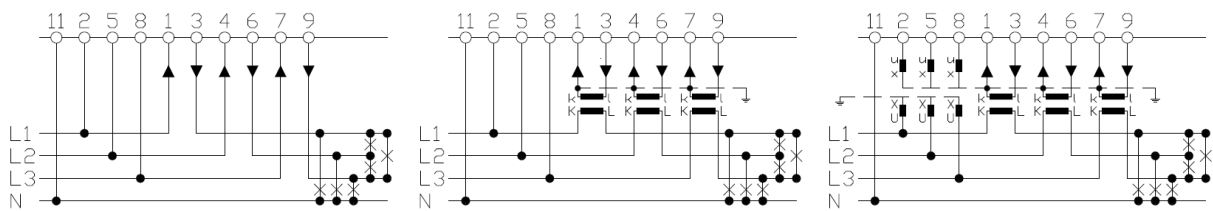
3-wire
3-phase asymmetrical load



-11

3-phase
3 elements

4-wire
3-phase asymmetrical load



3 Measuring

3.1 Measured quantities

Prefix	Quantity	Calculation	System / Phase
I	Input current	$(I1+I2+I3)/3$	System
I1	Phase current L1		L1
I2	Phase current L2		L2
I3	Phase current L3		L3
U	Input voltage	$(U1+U2+U3)/3$	System
U1	L1 Phase voltage		L1
U2	L2 Phase voltage		L2
U3	L3 Phase voltage		L3
P	Active power	$P1+P2+P3$	System
P1	Active power L1		L1
P2	Active power L2		L2
P3	Active power L3		L3
Q	Reactive power	$Q1+Q2+Q3$	System
Q1	Reactive power L1		L1
Q2	Reactive power L2		L2
Q3	Reactive power L3		L3
S	Apparent power	$S1+S2+S3$	System
S1	Apparent power L1		L1
S2	Apparent power L2		L2
S3	Apparent power L3		L3
U12	Main voltage L1-L2		L1 - L2
U23	Main voltage L2-L3		L2 - L3
U31	Main voltage L3-L1		L3 - L1
PF	Active power factor	P/S	System
PF1	Active power factor	$\cos(\phi1)=P1/S1$	L1
PF2	Active power factor	$\cos(\phi2)=P2/S2$	L2
PF3	Active power factor	$\cos(\phi3)=P3/S3$	L3
QF	Reactive power factor	Q/S	System
QF1	Reactive power factor	$\sin(\phi1)=Q1/S1$	L1
QF2	Reactive power factor	$\sin(\phi2)=Q2/S2$	L2
QF3	Reactive power factor	$\sin(\phi3)=Q3/S3$	L3
LF	LF factor	$\text{sign}(Q)*(1- PF)$	System
LF1	LF factor	$\text{sign}(Q1)*(1- PF1)$	L1
LF2	LF factor	$\text{sign}(Q2)*(1- PF2)$	L2
LF3	LF factor	$\text{sign}(Q3)*(1- PF3)$	L3
PA	Phase angel	$PA=(PA1+PA2+PA3)/3$	System
PA1	Phase angel	$\phi1=\arccos(P1/S1)/\pi*180*\text{sign}(P1)$	L1
PA2	Phase angel	$\phi2=\arccos(P2/S2)/\pi*180*\text{sign}(P2)$	L2
PA3	Phase angel	$\phi3=\arccos(P3/S3)/\pi*180*\text{sign}(P3)$	L3
IS	Input current with sign	$(I1+I2+I3)/3$	System
IS1	Phase current with sign	$I1*\text{sign}(P1)$	L1
IS2	Phase current with sign	$I2*\text{sign}(P2)$	L2
IS3	Phase current with sign	$I3*\text{sign}(P3)$	L3
P_I1_U12	Active power, System connection-02		System
P_I1_U23	Active power, System connection -03		System
P_I1_U31	Active power, System connection -04		System
Q_I1_U12	Reactive power, System connection -02		System
Q_I1_U23	Active power, System connection -03		System
Q_I1_U31	Active power, System connection -04		System
F	Frequency		System

3.2 Measuring system

3.2.1 Phase-Locked loop - PLL

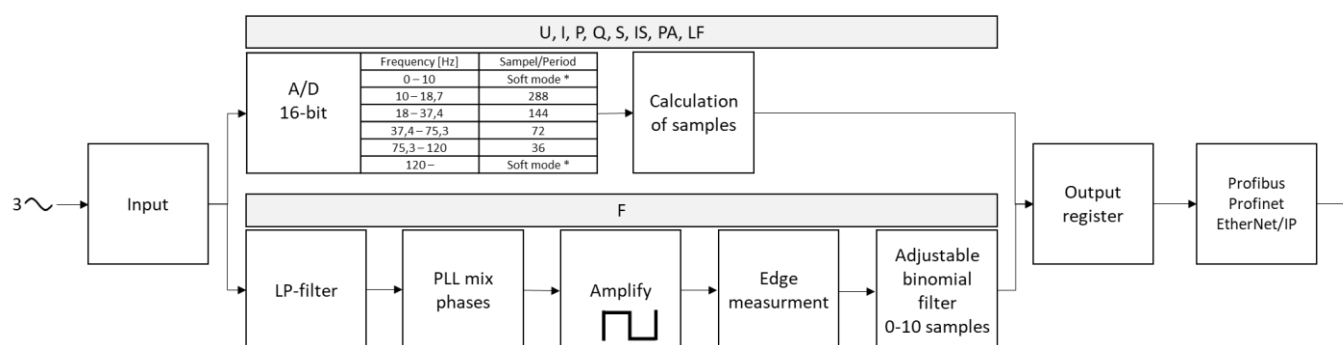
The measuring system use a phase-locked loop (PLL) between 10-120 Hz. All quantities are being measured. The number of samples per period is depending of the frequency.

3.2.2 Soft mode

A fixed sample rate of 1800 samples/second (soft mode) is used when the frequency is lower than 10 Hz or higher than 120 Hz. Measured quantities in soft mode are voltage (U), current (I) and frequency (F).

3.2.3 Block diagram

Schematic block diagram of measure process.



* *Soft mode = 1800 samples / second*

3.2.4 Frequency filter

The voltage inputs, including the neutral line, first pass through a low-pass filter (1-pole, cutoff at 3.4 kHz) to remove high-frequency noise.

Next, the signals are buffered and passed through DC-blocking filters (1-pole, cutoff at 0.033 Hz) to remove any offset. These signals are then sampled by the ADC with reference to the neutral.

An analog multiplexer selects two of the buffered signals (see table). The difference between these signals is filtered and amplified, and then converted into a square wave with the same frequency. This square wave is sent to the microcontroller for frequency detection.

A binomial filter is also available and can be set from 0 to 10 to further smooth the data.

System Connection	Frequency reference	
00, 01	U1	(UL1 – UN)
03	U32	(UL3 – UL2)
02, 05, 09, 11	U12	(UL1 – UL2)
04	U31	(UL1 – UL3)

4 Output – Profibus/Profinet

LQT40F have Profibus, Profinet or EtherNet/IP output for fast serial communication. Three different set of "Process Data Set Mapping" are available. Each mapping has a unique GSD-file. The files are available from Tillquist homepage.

4.1 Process Data Set Mapping

A: Basic – *Is the same mapping as old LQT60F*

B: Basic + High Resolution F

Parameters							Data Set	
Parameter	Range	Bus value	Type	Byte	Note		A	B
Bus Inc Num	-	-	0-65535	Unsigned Word	1-2	-	X	X
Data Inc Num	-	-	0-65535	Unsigned Word	3-4	-	X	X
I_RMS	0-12	A	0-65535	Unsigned Word	5-6	(I1+I2+I3)/3	X	X
U_RMS	0-300	V	0-65535	Unsigned Word	7-8	(U1+U2+U3)/3	X	X
P_RMS	±10800	W	±10800000	Signed Double Word	9-12	P=P1+P2+P3	X	X
Q_RMS	±10800	var	±10800000	Signed Double Word	13-16	Q=Q1+Q2+Q3	X	X
F	0-300	Hz	0-65535	Unsigned Word	17-18	-	X	X
F_HIRES	0-300	Hz	0-300000	Unsigned Double Word	19-22	-		X
A: Basic							Bus Increment Number increase with every new message.	
B: Basic + High Resolution F							Data Increment Number increase with every new measured	

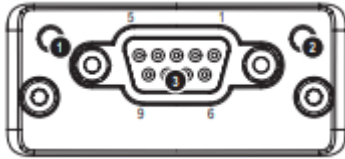
C: Extended

Parameters							Data Set	
Parameter	Range	Bus value	Type	Byte	Note		C	
Bus Inc Num	-	-	0-65535	Unsigned Word	1-2	-	X	
Data Inc Num	-	-	0-65535	Unsigned Word	3-4	-	X	
I_RMS	0-12	A	0-12000	Unsigned Double Word	5-8	(I1+I2+I3)/3	X	
U_RMS	0-300	V	0-300000	Unsigned Double Word	9-12	(U1+U2+U3)/3	X	
P_RMS	±10800	W	±10800000	Signed Double Word	13-16	P=P1+P2+P3	X	
Q_RMS	±10800	var	±10800000	Signed Double Word	17-20	Q=Q1+Q2+Q3	X	
F	0-300	Hz	0-300000	Unsigned Double Word	21-24	-	X	
I1	0-12	A	0-12000	Unsigned Double Word	25-28	-	X	
I2	0-12	A	0-12000	Unsigned Double Word	29-32	-	X	
I3	0-12	A	0-12000	Unsigned Double Word	33-36	-	X	
U1	0-300	V	0-300000	Unsigned Double Word	37-40	-	X	
U2	0-300	V	0-300000	Unsigned Double Word	41-44	-	X	
U3	0-300	V	0-300000	Unsigned Double Word	45-48	-	X	
U12	0-520	V	0-520000	Unsigned Double Word	49-52	-	X	
U23	0-520	V	0-520000	Unsigned Double Word	53-56	-	X	
U31	0-520	V	0-520000	Unsigned Double Word	57-60	-	X	
P1	±3600	W	±3600000	Signed Double Word	61-64	-	X	
P2	±3600	W	±3600000	Signed Double Word	65-68	-	X	
P3	±3600	W	±3600000	Signed Double Word	69-72	-	X	
Q1	±3600	var	±3600000	Signed Double Word	73-76	-	X	
Q2	±3600	var	±3600000	Signed Double Word	77-80	-	X	
Q3	±3600	var	±3600000	Signed Double Word	81-84	-	X	
LF	±1		±1000	Signed Double Word	85-88	-	X	
PA	±180	°	±180000	Signed Double Word	89-92	-	X	
C: Extended							Bus Increment Number increase with every new message.	
							Data Increment Number increase with every new measured	

4.2 Profibus

The address of the Profibus DP is set via the software ConfigLQT.

Front View, PROFIBUS Connector

#	Item	
1	Operation mode	
2	Status	
3	PROFIBUS Connector, 9-pin female D-Sub	

Operation Mode

LED State	Indication
Off	Not online / No power
Green	Online, data exchange
Flashing Green	Online, clear
Flashing Red (1 flash)	Parameterization error
Flashing Red (2 flash)	PROFIBUS Configuration error

Status

LED State	Indication
Off	Not initialized
Green	Initialized
Flashing Green	Initialized, diagnostic event(s) present
Red	Exception error

4.3 Profinet and EtherNet/IP

Communication settings for Ethernet parameters are set in ConfigLQT v3.

IP address	172.21.222.150
Subnet mask	255.255.255.0
Gateway	0.0.0.0
DHCP	☐

5 Commissioning

5.1 Programming of the transducer

"ConfigLQT" is a free configuration software, it is available for download from Tillquist homepage, www.tillquist.com. The software connects to the transducer and make it possible to change the configuration of adjustable parameters and to visualize live readings.

ConfigLQT supports offline configuration of adjustable parameters.

Save and load configuration file.

Functionality of ConfigLQT

ConfigLQT allows the user to:

- See online readings of measured values
- Adjust the functionality of the outputs
- Save parameter settings to a file
- Load parameter settings from a file
- Print settings report
- Upgrade firmware

5.2 USB configuration interface

The USB interface serves for configuration and commissioning of the transducer. It is not intended for measurement processing during normal operation!

5.3 LED functionality

LQT40F have two LEDs at front, *Power* and *Status*.

State	Power	Status
Start-up	Flashing - On 1 sec / Off 0.5 sec	Flashing - On 1 sec / Off 0.5 sec
Normal operation	On	Flashing - On 200 ms / Off 200 ms
Error	Flashing - On 100 ms / Off 100 ms	Off

6 Technical Data

	Technical Data	Details
Input	Voltage range (Un)	100 – 400 V (L-L) main voltage (nominal)
	Measuring range	1 – 520 V _{L-L} TRMS 50/60 Hz or 16⅔ Hz CAT III 1 – 300 V _{L-N} TRMS 50/60 Hz or 16⅔ Hz CAT III
	Frequency	50/60 Hz (10...40...70...120 Hz) 16⅔ Hz (10...15...18...120 Hz)
	Overload voltage	2 x Un – 10 s
	Consumption	Input impedance: 1.32 MΩ L-L; 1.32 MΩ L-N
	Current (In)	1 – 5 A
	Measuring range	5 mA – 10 A TRMS
	Overload current	2 x In continuously, 10 x In 15 s, 40 x In 1 s
	Consumption	<0.05 VA / phase
	Auxiliary power supply	24–230 VDC / 90–230 VAC 50/60 Hz ±10 %
	Burden	max 7.1 W / 15 VA
	Serial communication	Profibus or Profinet
	Profibus	DP-V0 and DP-V1 according to IEC61158 type 3
	Profinet	PROFINET RT Class 1 and 3 PROFINET IRT Ethernet switch
Output	EtherNet/IP	
General Data	Accuracy class	0.2 (Ref. temp. 23 °C)
	Galvanic isolation	Supply, in- and output are galvanically isolated
	Connection terminals / Torque	Input and Auxiliary power supply: 6 mm ² / 0.8 Nm Output: 2.5 mm ² / 0.5 Nm
	Humidity	95 % non-condensing
	USB	USB Micro-B, port for configuration
	Temperature	-10...+55 °C (operation) -40...+70 °C (storage) Temperature coefficient < 0.1 % / 10 °C
	Test voltage	4 kV AC / 1 min
	Measurement category	Cat. III
	Overvoltage category	Cat. III
	Pollution degree	2
	Dimension (W x H x D)	70 x 132 x 101 mm
	Weight	330 gr
	Protection	IP40 (housing), IK06
	Flammability class	UL94 V-0
	Standards	SS-EN 60688 Transducers SS-EN 61010-1 Safety IEC 61010-2-030 EN 61000-6-2 / -6-4 / -6-5

7 Ordering Codes

	LQT40F-	X	X	XXX
Communication				
Profibus		1		
Profinet		2		
EtherNet/IP		3		
Frequency				
50/60 Hz			0	
16⅔ Hz			1	
Other Requirements				
Standard configuration				000
Customer configuration (to provide ERF)				001
High precision with Frequency Test Certificate				201