TTL MEASUREMENT TRANSDUCER

user leaflet

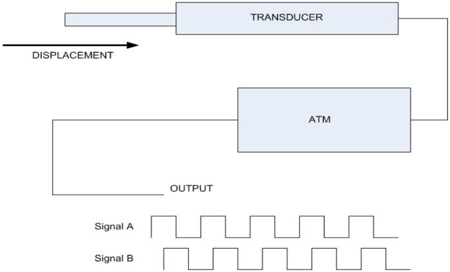
QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Product Description

Introduction

The Solartron ATM transducer comprises a sensor and conditioning electronics which provides an RS422 level square wave output. Each output pulse represents a discrete incremental displacement.



This type of square wave output, often called TTL can be read by many basic counter cards and instruments.

The major difference between the ATM and conventional incremental sensors which provide outputs of this type is that the ATM is an absolute sensor and therefore cannot lose its position even if it is moved quickly. Incremental sensors will miss count if moved too quickly, which means they need a reference signal at a known position to re-datum. The ATM does not need this and does not provide a reference signal.

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Safety

WARNING statements identify conditions or practices that could result in personal injury or loss of life

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property

Warnings and Cautions

Warning: do not operate in an explosive atmosphere.
Warning: this equipment is not intended for safety critical applications.
Warning : do not exceed the maximum ratings as specified in this document

This equipment operates below the SELV and is therefore outside the scope of the Low Voltage Directive

Symbols in this manual

⚠	Indicates cautionary or other information

Service and Repair

⚠	No user serviceable parts. Return to supplier for repair

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Operation

Output Signals Provided

The ATM provides four output signals in the form of square waves. These are Signals A and B. Signal B is phase shifted 90 degrees to Signal A. For each signal A and B the inverse signal is also transmitted.

The Signal A and the inverse signal A is often called a Differential Signal A and the Signal B and the inverse signal B a Differential Signal B.

Signal A is commonly referred to as the IN PHASE Signal and Signal B as the QUADRATURE Signal, where quadrature indicates a 90 degree phase shift with respect to the in phase signal.

QSS SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Operation

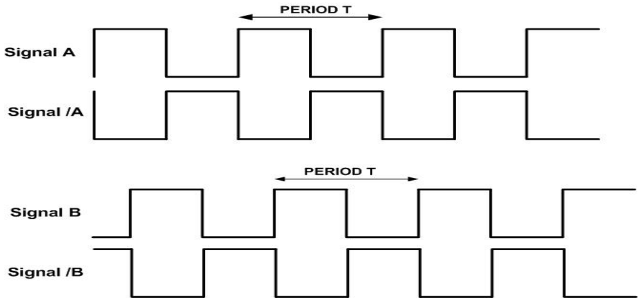


Figure 2: Output Signal Waveforms

The period of Signal A and Signal B is the same and therefore the Output Signal Frequency of A and B is:-

Output Signal Frequency = 1/PERIOD = 1/T

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Resolution

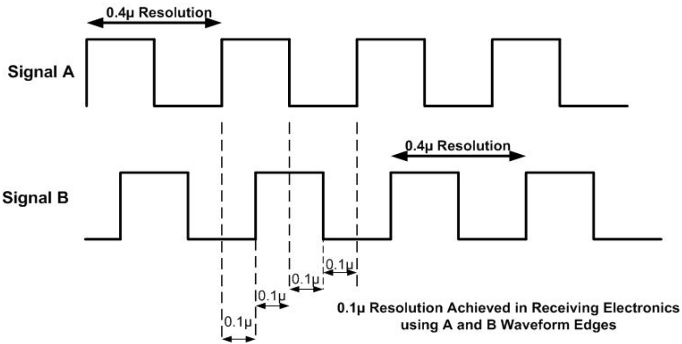


Figure 3: X4 Interpolation (performed in Receiving Electronics)

In figure 2 the period T of the signal corresponds to the resolution of the ATM. The ATM can be factory set to a specified resolution. These are 0.1 µm, 0.2 µm and 0.5 µm. **The resolution assumes x4 interpolation in the receiving electronics. (see opposite Fig 3).**

The period T of the separate A and B signals is therefore 0.4 µm, 0.8 µm, 2 µm.

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Direction of Count Pulses

For an inward displacement Signal A leads Signal B,

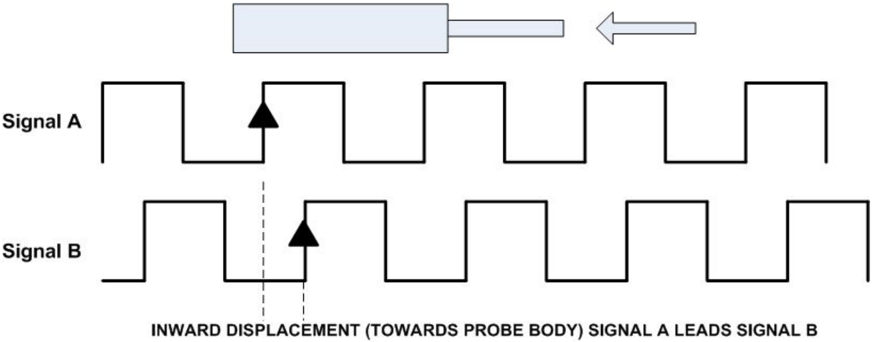


Fig 4a

QSS SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Direction of Count Pulses

For an outward displacement Signal B leads Signal A

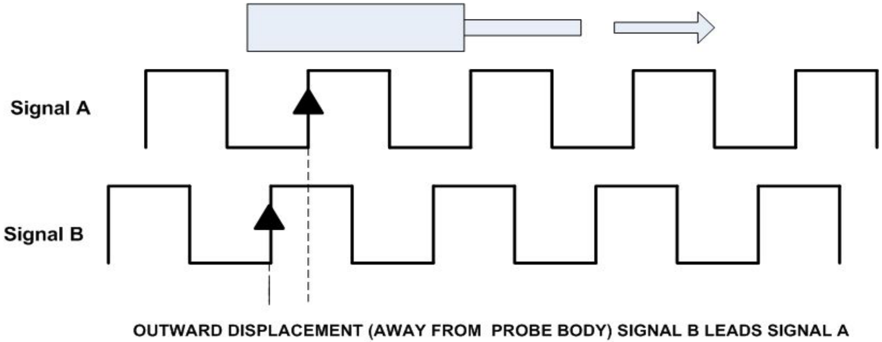


Fig 4b

Transmission of Count Pulses and Receiver Requirements

<u>Number of Pulses sent</u>

The ATM will send the exact number of pulses corresponding to the displacement moved. This will depend on the resolution set.

Number of A and B Pulses = Displacement (µm) / Selected resolution x 4.

E.g.   Selected Resolution = 0.1 µm. Displacement =1.5 mm

Number of A and B Pulses = (1.5*1000) / (0.1 X 4) = 3750 pulses.

The receiving electronics must be able to count x4 the Number of pulse edges to correctly count the pulses. (See Fig 3).

QSS SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Frequency of Pulses

Three factors affect the output frequency of Signals A and B from the ATM, these are:

- Maximum Output Signal Frequency, which is factory set. The ATM will never transmit at a higher frequency than this setting.
- The ATM resolution.
- The speed at which the probe is moved.

The output frequency of Signals A and B is calculated from the equation.

$$\text{Output frequency} = \frac{\text{Rate of change of Displacement (mm/sec)*1000}}{\text{ATM Resolution x 4}}$$

QSS SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Frequency of Pulses

Three factors affect the output frequency of Signals A and B from the ATM, these are:

Table 1 below shows the relationship between Rate of change of Displacement (how fast the probe is moving) and the Output frequency for an ATM with a factory set resolution of 0.1 µm and a factory set maximum Output Frequency of 100 kHz.

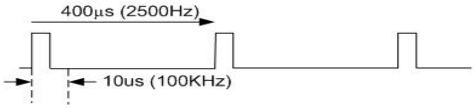
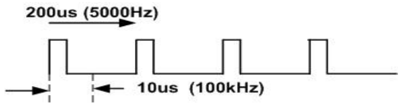
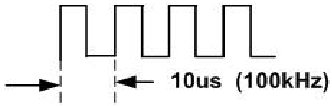
<table>
<tr><th>Rate of Change of displacement</th><th>ATM Resolution</th><th>Output Frequency</th><th rowspan="8"></th></tr>
<tr><td>mm/sec</td><td>µm</td><td>Hz</td></tr>
<tr><td>1</td><td>0.1</td><td>2500</td></tr>
<tr><td>2</td><td>0.1</td><td>5000</td></tr>
<tr><td>5</td><td>0.1</td><td>12500</td></tr>
<tr><td>10</td><td>0.1</td><td>25000</td></tr>
<tr><td>20</td><td>0.1</td><td>50000</td></tr>
<tr><td>50</td><td>0.1</td><td>100000</td><td rowspan="2">Output Frequency Limited by maximum Output Signal Frequency</td></tr>
<tr><td>100</td><td>0.1</td><td>100000</td></tr>
</table>

Table 1: Rate of Change of Displacement and Output Frequency

QSS SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Frequency of Pulses

Example: Output Waveforms. (ATM set to 0.1 µm resolution, Max Output Frequency = 100 kHz)

	Probe moving at 1 mm/sec, therefore 2500 A pulses per second.
	Probe moving at 2 mm/sec, therefore 5000 A pulses per second.
	Probe moving at 50 mm/sec, therefore limited to Maximum Output frequency (100 kHz)

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Frequency of Pulses

ATM system Lag

Once the probe is moving sufficiently fast that its Output Signal Frequency is limited by the factory set Maximum Output Signal Frequency then lag will be introduced into the measurement. This must be considered if the ATM is being used in a control application.

ATM Bandwidth

The ATM has a measurement bandwidth of 100 Hz. If it is used to measure signals with a frequency greater than 100 Hz then information about this signal will be lost.

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Receiver Electronics

The receiver electronics must be able to handle signals up to 4 times the Maximum Output Signal frequency to ensure correct operation and not lose count.

ATM Maximum Output Signal Frequency	Minimum Frequency for Receiver
kHz	kHz
50	200
100	400
125	500
180	720
250	1000
360	1440
500	2000

Table 2: Receiver Electronics Input Frequency Requirements

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Pre and Post Travel Positions

The ATM is set so that the probe has a pre and post travel region outside of the measurement range. If the probe is within the pre or post travel no signals are transmitted.

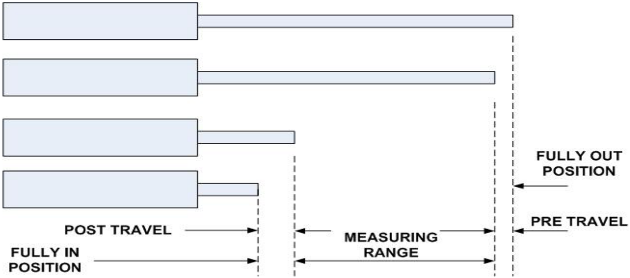


Figure 5: Pre and Post Travel

QSS SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Absolute Mode and Incremental Mode

These options can be factory set.

In Absolute mode, on power on the ATM will read its absolute position and send pulses to the receiver corresponding to this position.

In incremental mode, on power on the ATM will treat this position as zero and will not send any pulses until it is moved.

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Indication Lamps

The ATM has two indication lamps.

Condition	Blue LED	RED LED
Probe Moving (>10µm)	Flash	
Low Voltage warning (ATM still operates) **		Flash 20% On 80% Off
Low or High Voltage Error		Flash 80% On 20% Off
Hardware Error		On

** The ATM requires a +5 V ± 0.25 VDC Supply. If the voltage is outside of this range a warning is indicated, however the ATM will continue to operate. If the voltage is worse than 0.5 V out of range an error is indicated and the ATM stops transmitting signals.

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Technical Data

Measurement Performance	
Transducer Range	0.5 mm to 150 mm depending on Probe Type fitted
Accuracy	Up to 0.15% reading depending on probe Type fitted
Resolution (x 4 interpolation)	0.1, 0.2 or 0.5 µm (factory set)
Repeatability	<0.15 µm depending on Probe Type Fitted
Electrical Performance	
Power	+5 V ± 0.25 VDC @ 100 mA
Output Signals (differential)	A and B, /A and /B (TTL / RS422)
Maximum Output Frequency	50, 100, 125, 250, 360, 500 kHz (factory set)
Bandwidth	100 Hz

QSS
SENSORS AND COMPONENTS
QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Technical Data

Environmental	
Sealing	Transducer: typically IP65 depending on type. Electronics Module IP43
EMC	EN61000-6-3 Emissions EN61000-6-2 Susceptibility
Operating Temperature	0 ºC to 60 ºC
Storage Temperature	-20 ºC to 70 ºC
Air Supply (Pneumatic Probes)	Clean and Dry Air, maximum RH 60%, filtered to better than 5 µm (0.1 µm for specialist transducers with ultra low tip force). If unsure check with factory.
Operating Pressure (Pneumatic Probes)	Depends on Probe Type fitted. If unsure check with factory.

QSS Quality Systems Solutions GmbH
Aemetstrasse 5
CH-8344 Bäretswil
T 0041 44 242 0000
F 0041 44 242 0010
info@qss-solutions.ch
www.qss-solutions.ch

Electrical Connections

The ATM is normally supplied with 2 m of cable between the probe and the electronics module and 1 m between the electronics module and the connector or free wire end.

Signal	Description	Wire Ended	15 Way D Type (Heidenhain Pin Out)	15 Way D Type High Density
A	In Phase	Red	1	1
/A	In Phase Inverted	Pink	9	2
B	Quadrature	Yellow	3	3
/B	Quadrature Inverted	Green	11	4
Supply (+5 V ± 0.25 VDC)	Power Supply	Blue	4 & 12	13
Return (0V)	Return (0V)	Black	2 & 10	14