Allen-Bradley

Dynamix 1444 Series Monitoring System Specifications

Catalog Numbers 1444-DYN04-01RA, 1444-TSCX02-02RB, 1444-RELX00-04RB, 1444-AOFX00-04RB, 1444-TB-A, 1444-TB-B

Summary of Changes

This publication contains new and updated information as indicated in the following table.

Topic	Page
Signal Conditioning	8
Transient Capture	12
Complex Measurement Specification	10
TSC Module Functional Specification Table	16
Configuration Software	19

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

The Dynamix™ series of intelligent I/O modules provide an integrated, distributed solution for monitoring the condition of your critical machinery. The system can monitor and protect motors, pumps, fans, gearboxes, steam and gas turbines, high-speed compressors, and other rotating or reciprocating machines.

The system can measure dynamic signals such as vibration, strain or pressure, and position measures such as thrust, differential expansion, or rod position. Measurements are made in real time to protect industrial machinery from imminent failure, and/or, are further processed to calculate critical fault indicating parameters that can be used to assess the machines current and predicted health.

Configuration and management of the Dynamix system is accomplished through a Logix controller(1), linked via an EtherNet/IP industrial network. As part of the Rockwell Automation® Integrated Architecture, other system components such as controllers, visualization products, other input/output products, and more can be easily applied to tailor a solution to the specific needs of the application.

(1) The Dynamix system performs its protection function regardless of the availability of the controller.

The Dynamix series consists of just six core part numbers and various accessories for connectors and cables.

Table 1 - 1444 Series Catalog Numbers

Type	Module	Cat. No.	Page
Measurement modules	Dynamic measurement module	1444-DYN04-01RA	5
Speed modules	Tachometer signal conditioner expansion module	1444-TSCX02-02RB	14
Relay modules	Relay expansion module	1444-RELX00-04RB	16
Analog output modules	4…20 mA expansion module	1444-AOFX00-04RB	17
Terminal bases	Dynamic measurement module terminal base	1444-TB-A	19
	Expansion module terminal base	1444-TB-B	19

Table 2 - Removable Plug Connector Sets

Module	Spring Connector	Screw Connector	Page
1444-DYN04-01RA	1444-DYN-RPC-SPR-01	1444-DYN-RPC-SCW-01	20
1444-TSCX02-02RB	1444-TSC-RPC-SPR-01	1444-TSC-RPC-SCW-01	20
1444-RELX00-04RB	1444-REL-RPC-SPR-01	1444-REL-RPC-SCW-01	20
1444-AOFX00-04RB	1444-AOF-RPC-SPR-01	1444-AOF-RPC-SCW-01	20
Terminal Base			
1444-TB-A	1444-TBA-RPC-SPR-01	1444-TBA-RPC-SCW-01	20
1444-TB-B	1444-TBB-RPC-SPR-01	1444-TBB-RPC-SCW-01	20

Table 3 - 1444 Series Interconnect Cable Accessories

Cat. No.	Description	Page
1444-LBIC-04	Local bus interconnect cable (qty 4)	21
1444-LBXC-0M3-01	Local bus extender cable (0.3 m)	21
1444-LBXC-1M0-01	Local bus extender cable (1.0 m)	21

You can view or download publications at http://www.rockwellautomation.com/literature. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Dynamix 1444 Series Common

Dynamix 1444 series modules are designed to serve the condition monitoring requirements of rotating and reciprocating industrial machinery. The family includes the 1444-DYN04-01RA high performance, highly configurable main module. The 1444-TSCX02-02RB modules provide tachometer signal conditioning. The 1444-RELX00-04RB relays, 1444-AOFX00-04RB analog outputs, and 1444-TB-A/B terminal bases are also included in the family. The modules are applied in combinations as necessary to the application.

All 1444 series modules and terminal bases share the following common hardware specifications.

Table 4 - 1444 Series Common Hardware Specifications

Attribute	1444-DYN04-01RA, 1444-TSCX02-02RB, 1444-RELX00-04RB, 1444-AOFX00-04RB, 1444-TB-A/B
Technical Specifications	
Enclosure type rating	None (open-style)
North American temp code	T4
IEC temp code	T4
Power	
Voltage	North American: 18...32V, max 8 A, Limited Voltage Source ATEX/IECEx: 18...32V, max 8 A SELV/PELV Source
Conformal Coating	
All printed circuit boards are conformal coated in accordance with IPC-A-610C and in compliance with:	• IPC-CC-830 B • UL508
Environmental Specifications	
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock):	-25…70 °C (-13…158 °F)
Temperature, surrounding air, max	70 °C (158 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged nonoperating Dry Heat), IEC 60068-2-14 (Test N/A, Unpackaged nonoperating Thermal Shock):	-40…85 °C (-40…185 °F)
Relative humidity IEC 60068-2-30 (Test dB, Unpackaged Damp Heat):	5…95% noncondensing
Vibration Per IEC 600068-2-6 (Test Fc, Operating):	2 g @ 10…500 Hz

Table 4 - 1444 Series Common Hardware Specifications

Attribute	1444-DYN04-01RA, 1444-TSCX02-02RB, 1444-RELX00-04RB, 1444-AOFX00-04RB, 1444-TB-A/B
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock):	15 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock):	30 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2:	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3:	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50 % Pulse 100% AM at 900 MHz 1V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
Conducted RF immunity IEC 61000-4-6:	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz
Certifications(1)	
c-UL-us	UL Listed Industrial Control Equipment, which is certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, which are certified for U.S. and Canada. See UL File E194810.
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab, Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2006/95/EC LVD, compliant with:(2) EN 61131-2; Programmable Controllers (Clause 11)
RCM	EN 61000-6-4; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex N/A IIC T4 Gc • II 3 G Ex N/A nC IIC T4 Gc (only 1444-DYN04-01RA and 1444-RELX00-04RB) • DEMKO14ATEX1365X
IECEx	IECEx System, compliant with: • IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" • IEC 60079-0; General Requirements • II 3 G Ex N/A IIC T4 Gc • II 3 G Ex N/A nC IIC T4 Gc (only 1444-DYN04-01RA and 1444-RELX00-04RB) • IECEx UL 14.0082X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3

(1) When product or packaging is marked see the Product Certification link at http://www.rockwellautomation.com/ for Declarations of Conformity.
(2) Applies to only 1444-DYN04-01RA and 1444-RELX00-04RB modules.

API-670 Compliance

The 1444 series is designed in accordance with the relevant sections of the 5th Edition of the American Petroleum Institutes (API) standard 670,(1) 'Machinery Protection Systems'.

Local Bus

The 1444 series family includes a power and communication bus that, similarly to the backplane of a rack-based system, connects a series of modules.(2) The local bus is implemented by using simple ribbon connectors that typically span adjacent modules.(3)

Table 5 - Local Bus Function

Attribute	Description
Power	Passes power from each main module (1444-DYN04-01RA) to its expansion modules
	Power is not passed between main modules
	When redundant power supplies are connected to a main module, only the voted power source is distributed to its expansion modules.
TTL signals	Dual independent TTL signals, with tachometer sensor status, are passed on the Local Bus
	There can be only one tachometer expansion module on a local bus
	The TTL signal can serve up to six main modules
Communication	A digital network that is used between a main module and its expansion modules is implemented on the local bus
	Communication does not link main modules

Insert and Remove Under Power

WARNING:

- If you insert or remove the module while backplane power is on, an electric arc can occur. This arc could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.
- If you connect or disconnect wiring while the field-side power is on, an electric arc can occur. This arc could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

All 1444 series modules can be removed and replaced while power is applied to its terminal base(4)(5).

(1) Whether a system is compliant is dependent on the components that are provided, the various optional elements of the standard that you require, and the configuration of the installed system.
(2) Any main module must be installed to the left of any expansion modules that it manages.
(3) A short ribbon cable, suitable for connecting adjacent modules, is included with each terminal base. See the Accessories, section of this publication for a description of available extended length cables.
(4) If a removed module includes an energized relay, the relay goes to its de-energized state.
(5) If Ethernet is daisy chained, one module to the next, and DLR is not used, removal of a main module causes the loss of Ethernet communication to all 'downstream' main modules.

Mounting and Connections

DIN Rail

Terminal bases require DIN mounting by using 35 x 7.5 mm rail.

1444 series modules do not connect ground to the DIN rail, therefore coated DIN rail is acceptable.

Wiring Connectors

Field wiring landed to 1444 series modules and terminal bases are via 45°, front access, removable plug connectors with screw, and spring-cage connectors available(1).

Each connector is keyed such that it can be inserted into the location on the module or terminal base that it serves. Connectors are secured in place by quarter-turn screws.

Table 6 - Field Wiring Termination Requirements

Attribute	Description
Conductor type	Copper
Conductor/ insulation temperature rating, min	85 °C (185 °F)
Operating temperature, max (screw type only)	115 °C (239 °F)
Operating temperature, max (spring type only)	105 °C (221 °F)
Torque (screw type only)	0.22… 0.25 N•m (2…2.2 lb•in)
Stripping length	9 mm (0.35 in.)
Conductor cross-section solid or stranded	0.14…1.5 mm² (26…16 AWG)
Conductor cross-section stranded with ferrule without plastic sleeve	0.25…1.5 mm² (24…16 AWG)
Conductor cross-section stranded with ferrule with plastic sleeve	0.25…0.5 mm² (24…20 AWG)
Conductor cross section AWG/kcmil	0.08…1.5 mm² (28…16 AWG)
Conductor UL/cUL AWG (screw type only)	0.05…1.5 mm² (30…16 AWG)
Conductor UL/cUL AWG (spring type only)	0.08…1.5 mm² (28…16 AWG)

(1) A spring cage or screw clamp Removable Plug Connector set must be purchased for each module and terminal base ordered. See Table 2 for available catalog numbers.

Controller Independence

While the 1444 series is dependent on a Logix controller for its initial configuration, it is not dependent on the controller to perform its protection function. If communication with the controller is lost, the system continues to perform measurements, evaluate alarm conditions and, if necessary, actuate its relays. It also remains available to serve data to other hosts(2) that can remain accessible.

Nonvolatile Memory

After its initial configuration, a 1444 series Main Module maintains its configuration in nonvolatile memory. After any subsequent power cycle, the module loads its configuration from the nonvolatile memory and resumes its normal function. This process makes sure that even if the controller is not accessible after powerup that the monitor performs its function.

Dynamic Measurement Module 1444-DYN04-01RA

The Dynamix 1444 Series dynamic measurement module has four channels and uses general-purpose monitoring. The dynamic measurement module serves industrial machinery protection and condition monitoring applications. The module supports measurements of dynamic inputs such as vibration and pressure. The module supports measurements of and static inputs such as thrust, eccentricity, and rod drop. The module can be used for monitoring the following:

- Shaft vibration
- Casing vibration
- Pedestal vibration
- Shaft and rod position
- Casing expansion
- Other critical dynamic and position measurements on rotating and reciprocating machinery

(2) Only the controller that 'owns' a module can change its configuration. Other processors such as personal computers, DCS computers, or other controllers, can query the module for data.

To achieve this degree of adaptability, the module couples an extraordinarily flexible firmware and a powerful multi-processor hardware platform.

The 1444-DYN04-01RA module is designed specifically for integration with Allen-Bradley® (Logix5000™) controllers that are connected across an industrial Ethernet network. This design makes the 1444 series unequaled in its ability to serve as a synergetic member of larger total facility control and information management systems.

Hardware Specifications

Table 7 - 1444-DYN04-01RA H/W Specifications

Attribute	Description	
Channel Inputs (4)		
Sensor types	ICP accelerometers (CCS) Dynamic pressure transducers Dual sensors (acceleration + temperature) Eddy current probe systems (-24V DC) Self-powered sensors Voltage signals	
Transducer positive power	Constant current: 4 mA @ 24V	
	Voltage regulated: 24V/25 mA	
Transducer negative power	Voltage regulated: -24V/25 mA	
Voltage range	± 24V DC	
Isolation	Non-isolated, single-ended analog inputs. Sensor signal returns must be isolated from ground	
Impedance	>100 kΩ	
Protection	Reverse polarity	
Transducer fault detection	Bias level high / low limits	
	Current threshold level monitoring, which is implemented in hardware for -24V supplied sensors. Provides the fastest fault detection possible with excellent reliability.	
A/D Converter		
Conversion	24 bit	
Accuracy	±0.1 % (typical) see publication 1444-UM001C for further information	
Resolution	3 µV (theoretical)	
Dynamic range	80 dBfs (0.01 % fs), 90 dBfs typical	
Sample rate	2 Channels	93 kS/s
	4 Channels	47 kS/s
Tachometer Inputs (2)		
Terminal inputs	TTL class with internal pull-up resistor (5V DC)	
Local bus inputs	Opto-isolated TTL input for signal and TX status	
Detection threshold	Fixed (-2.5V DC)	
Transducer status	Only local bus inputs	
Protection	Reverse polarity	

Table 7 - 1444-DYN04-01RA H/W Specifications

Attribute	Description
Digital Inputs (2)	
Connection	Terminal pins
Type	TTL class
Power	32V DC, 15 mA max per output
Isolation	Non-isolated
Application	Trip inhibit/bypass Alarm/relay reset Alarm SPM/gate control 0, 1 Tachometer 0, 1 status
Digital Outputs (2)	
Connection	Terminal pins
Type	Opto-isolated open-collector
Power	32V DC, 15 mA max per output
Application	Module status Tachometer 0, 1 TTL Tachometer 0, 1 status Replicate digital input 0, 1 Transducer 0…3 Status Voted alarm 0…12 status
Buffered Outputs (4)	
Connections	Terminal pins
	BNC
Protection	Short circuit protected
Power	± 24V, 8 mA max per output
Relay (1)	
Contact arrangement	Single pole double throw (SPDT) Change-over contact
Rating	250V AC/24V DC, 5 A max @ 40 °C (104 °F), 2 A @ 70 °C (158 °F)
Indicators	
Status indicators (16)	Power Module status Network status Processor status Processor operating state DSP status DSP operating state Channel status (4) Relay status Ethernet link status (2) Ethernet activity indicator (2)
Real-Time Clock	
Synchronization	IEEE-1588 standard V2 CIP Sync (ODVA)
Accuracy	Max drift: 100 ms per year
Communication	
Ethernet	Connector (2): RJ45, shielded Speed: 10 MB/100 MB Modes: half/full duplex Operation: auto-switching - auto negotiation - auto mitigation
Communication protocol	ODVA-compliant (conformance tested) EtherNet/IP industrial protocol

Table 7 - 1444-DYN04-01RA H/W Specifications

Attribute	Description	
Supported connectivity protocols	Single Ethernet (IEEE 802.3) Device Level Ring (ODVA)	
IP address	Set by hardware switch on the terminal base	
	Set in configuration	
Concurrent access	Controller (owner)	
	Up to 3 (more) sessions	
Power		
Connections (2)	Terminal pins	
Current	411 mA @ 24V (546…319 mA @ 18…32V)	
Consumption	11.5 W	
Dissipation	9 W	
Redundant power	Two 18…32V DC, max 8 A SELV power supply inputs	
	Higher voltage supply is applied to main and expansion modules	
PowerMonitor™	The two power supply voltage levels are monitored. Status indicated via process operating status indicators and on controller input (I/O).	
Isolation voltage	50V (continuous), basic insulation type between Ethernet, power, ground, and AUX bus 50V (continuous), basic insulation type between signal ports, power, ground, and AUX bus 250V (continuous), basic insulation type between relay ports and system No isolation between signal ports and Ethernet ports No isolation between individual signal ports or Ethernet ports Relay ports type tested at 1500V AC for 60 s All other ports type tested at 707V DC for 60 s	
Environmental		
EFT/B Immunity IEC 61000-4-4:	±2 kV at 5 kHz on unshielded power ports ±2 kV at 5 kHz on shielded signal ports ±2 kV at 5 kHz on shielded Ethernet ports ±3 kV at 5 kHz on unshielded relay ports	
Surge Transient Immunity IEC 61000-4-5:	±1 kV line-line(DM) and ±2 kV line-earth(CM) on unshielded power and relay ports ±2 kV line-earth(CM) on shielded signal ports ±2 kV line-earth(CM) on shielded Ethernet ports	
Terminal Base		
Requires terminal base 1444-TB-A		
Removable Plug Connector Sets		
Module	Spring	1444-DYN-RPC-SPR-01
	Screw	1444-DYN-RPC-SCW-01
Terminal base	Spring	1444-TBA-RPC-SPR-01
	Screw	1444-TBA-RPC-SCW-01
Dimensions		
Definition	H: Height above DIN rail	
	W: Width along DIN rail	
	D: Depth across DIN rail	
Without terminal base (H x W x D)	106 x 102 x 154 mm (4.17 x 4.02 x 6.06 in.)	
With terminal base (H x W x D)	125 x 102 x 158 mm (4.92 x 4.02 x 6.22 in.)	

Table 7 - 1444-DYN04-01RA H/W Specifications

Attribute	Description
Weight	
Without terminal base	0.40 kg (0.88 lb)
With terminal base	0.58 kg (1.28 lb)
Wiring	
Wiring category(1)	2 - on signal ports 2 - on power ports 2 - on communications ports 1 - on relay ports
Wire type	Shielded on signal connections Only Shielded on Ethernet ports Unshielded on power and relay ports

(1) Use this Conductor Category information for planning conductor routing. See Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Functional Specifications

The capabilities of the 1444-DYN04-01RA module vary depending on configuration.

The selected module personality defines the application of the channels and the available sample rates per channel, see Table 8.

Table 8 - Module Personalities

Real Time	Description
Four channel dynamic (4 kHz) or static	All channels are available. Each channel pair can be defined for either Static (DC) or Dynamic (AC) measurements. Dynamic channels can be configured for an FMAX up to 4578 Hz (274.7 kCPM).
Four channel dynamic (4 kHz), dual path	Measurement is the same as "four channel dynamic (4 kHz) or static". Inputs are internally connected between channels 0 and 2 and between channels 1 and 3.
2 channel dynamic (20 kHz), 2 channel static	Channels 0 and 1 can be configured for Dynamic (AC) measurements with an FMAX of up to 20.6 kHz (1236 kCPM). Channels 2 and 3 available for Static (DC) measurements.
2 channel dynamic (40 kHz)	Channels 0 and 1 (pair) can be configured for Dynamic (AC) measurements with a measurement span of 40 kHz(1), or as gSE. Channels 2 and 3 are disabled (off).
Multiplexed	Description
4 channel dynamic (40 kHz) or static	Channels can be configured in pairs (0 and 1, 2 and 3) for Dynamic (AC) measurements with a measurement FMAX of 40 kHz(1), as gSE, as Static (DC) measurements, or off.

(1) The 40 kHz personality provides high frequency overall and gSE measurements. The maximum possible FFT FMAX available from a 40 kHz personality is 2747 Hz (164.8 kCPM).

The module can measure static values such as position from proportional (DC) voltages, but it is designed to make dynamic measurements. Dynamic measurements are typically of vibration but can also be of pressure, strain, or other signals.

Table 9 - Supported Engineering Units

Signal Type	Engineering Units
Acceleration	m/s^2, $inch/s^2$, g, mm/s^2, mg, RPM/min
Velocity	m/s, inch/s, mm/s
Displacement	m, mm, micron, inch, mil
Spike energy	gSE
Temperature	°K, °C, °F
Voltage	V, mV
Current	A, mA
Power	W, kW, MW, VA, kVA, VAR, kVAR,
Pressure	Pa, kPa, MPa, bar, mbar, psi
Frequency	Hz, cpm, RPM
Flow	l/min, cgm, US g/min, m3/min
Other	EU

The signal source (input) to dynamic measurements is selectable from up to four points in the signal processing path. Signal sources include the output of the analog to digital converter, before and after the high pass filter within the 'primary' signal processing path, and from the output of an entirely independent 'alternate' signal processing path, see Table 11.

Table 10 - Measurement Data Sources

Meas. Source	Description
ADC out	Signal out of the ADC
Mid filter	Before high pass filter and integration
Post filter	After high pass filter and integration
Alternate path	Alternate signal path

Signal Conditioning

Table 11 - 1444-DYN04-01RA Signal Conditioning

Attribute	Description
Maximum frequency	4 Ch. protection: 4 kHz
	2 Ch. protection: 20.6 kHz
	Surveillance: 40 kHz (OA only)
Low pass filter	-3 dB corner 10 Hz to 40 kHz
	-24, -60 dB/octave
Signal detection	Peak to peak Peak RMS Calculated peak to peak Calculated peak
Primary Path Signal Conditioning	
Sampling mode	Asynchronous

Table 11 - 1444-DYN04-01RA Signal Conditioning

Attribute	Description
Bandwidth FMAX (1)	35 Hz…20.6 kHz
High pass filter	-3 dB corner: 0.1 Hz to 1 kHz
	-24, -60 dB/octave
Integration	None, single or double
Alternate Path Signal Conditioning	
Sampling mode	Asynchronous
	Synchronous
Asynchronous mode FMAX(1)	30 Hz…4578 Hz
Synchronous mode	Tachometer source: 0, 1
	Samples per rev: 8…128
	Orders: 2.0…31.3
Special Dynamic Signal Conditioning	
Absolute shaft	Per channel pair
	Ch-0/2: displacement
	Ch-1/3: acceleration or velocity
	Relative mounting: 0°, 180°
gSE	2 gSE channels max
	Only 2-channel protection or surveillance modes
	Overall, only TWF/FFT
	HPF: 200, 500 Hz, 1, 2, 5 kHz
	FFT FMAX: 100 Hz…5 kHz

(1) See Table 7

Real-Time Measurements

Real-Time measurements are made on the Primary Path signal-source data stream. How quickly these measurements update is dependent on the selected module personality. See Table 12.

Table 12 - Real-time Measurement Specifications

Personality	Update Rate
Real time	40 ms

Attribute (#)	Description	
Overall (8)	Number per channel: 2	
	Signal detection	
	Data source: OA 0: post filter (fixed) OA 1: ADC out/mid filter (selectable)	
	Time constant	
Tracking filters (16)	Number per channel: 4	
	Data source: ADC out	
	Roll Off: -48 dB/octave	
	Per channel	Signal detection
		Integration: none, single, double
		Revolutions (resolution)
	Per filter	Enable
		Speed reference: 0 or 1
		Order: 0.25…32x
	Measure	Magnitude
		Phase (integer orders)
SMAX (2)	Per channel pair	
Not 1x (4)	Number per channel: 1	
Bias/gap (4)	Number per channel: 1	
Shaft absolute (2)	Per channel pair	
gSE overall (2)	Number per channel: 1	

The module supports common DC and rod drop measurements. When specified, these measurements are also Real-Time measures.

Table 13 - Static (DC) Measurements

Attribute	Description	
Measurement type	DC measurement	
	Rod drop	
DC Measurements		

Table 13 - Static (DC) Measurements

Attribute	Description	
Measurement types	Proportional voltage	
	Eccentricity	
	Position	Normal (thrust)
		Radial cancel (ramp) differential expansion
		Head to head (complimentary) differential expansion
Rod Drop Measurement		
Trigger source	Speed reference: 0 or 1	

Continuous Measurements

Continuous measurements include the complex time waveforms and FFTs, and the FFT band values. Because time waveforms are captured with 'maximum overlap', they can be updated rapidly. However, as these measures are second in priority to any defined real-time measurements, how fast they update is dependent on configuration.

Two complex data measurements can be defined, each with its own data source and TWF/FFT attribute definitions.

One continuous complex data measurement is applied uniquely to the FFT Band measurements. As the band values are the only use of these complex data, the source TWF / FFT are not otherwise available.

Table 14 - Continuous FFT Band Measurements

Personality	Update Rate
Data source	Selectable
Real time	100 ms (typical)

Attribute	Description
FFT (4)	Number of lines: 600, 1000, 1800
	Averaging: exponential
	Number of averages(1): 1, 2, 3, 6, 12, 23, 45, 89 or 178
	Windows: none, flat top, hamming, hanning
FFT bands (32)	Number per channel: 8
	Measurement: OA, max peak amp, max peak Hz
	Domain: Hz, orders
	Order domain speed ref: 0, 1

(1) If the Time Waveform data source is Alternate Path, and the Alternate Path processing mode is Synchronous, averaging is performed in the time domain.

The second continuous data measurement is for the time waveform and FFT that are written to the alarm, trend (trend and alarm capture), and dynamic measurement buffers. These measurements are also the TWFs and FFTs that are served to a remote host when the 'live' complex measurements are requested.

Table 15 - Complex Measurement Specification

Attribute	Description
Data format	32-bit float
Time waveform (4)	Number per channel: 1
	Block size: 256…8,192
	Overlap: continuous maximum overlap
	Data source: selectable
FFT (4)	Number of lines: 75…1,800
	Averaging: exponential
	Number of averages: 1, 2, 3, 6, 12, 23, 45, 89 or 178
	Windows: none, flat top, hamming, hanning
gSE FFT (2)	Number per channel: 1
	Number of lines: 100…1,600
	Averaging: exponential
	Number of averages: 1, 2, 3, 6, 12, 23, 45, 89 or 178

Demand Measurements

Demand measurements are unscheduled data requests from the controller or computers. These data are typically measured from another source, at another resolution, or with another Fmax from the continuous measures.

Because for protection applications the real time and continuous measurements must meet minimum required update rates, demand data is executed as a background process, as time is available. Therefore how fast demand data can be serviced is dependent on module configuration and the modules activity when the request is made.

Table 16 - Demand Measurement Specifications

Personality	Update Rate
Real time	500 ms (typical)
Multiplexed	Configuration dependent
Data source	Selectable: post filter, mid filter, alternate path
Attribute	**Description**

Table 16 - Demand Measurement Specifications

Personality	Update Rate
Time waveform	Block size: 256…65,536
	Sample rate: ≤Fmax
FFT	$FMAX^{SP}$: Fmax for the signal path of the selected data source
	FFT Lines: 75…14400

Speed Measurements

The 1444-DYN04-01RA module includes two-speed inputs. The source of the speed measures can be a TTL signal or values that are passed to the module on its Input Table.

The speed values are applied to measurements, not channels. The measurements that are made on signals that are applied to any channel can be processed by using speed values.(1)

Table 17 - Speed Measurement Specifications

Attribute (#)	Description	
Speed (2)	Number per module: 2	
	Source: selectable per speed	
	Local bus: TTL Transducer status	
	Terminal pins: TTL	
	Input table: RPM Transducer status Accuracy: Speed measurement accuracy is per Table 27, when configured with a 4 kHZ Module Personality (per Table 8). High frequency configurations can reduce speed measurement accuracy and responsiveness.	
Speed maximum (2)	1 per speed measurement	
	Maximum speed since reset	
	Reset via controller I/O	
Speed acceleration (2)	1 per speed measurement	
	Units: RPM/min	
	Update rate: 1 / second	
Mode	Normal	Two independent speeds
	Redundant	Speed 0 = Speed 1 when tach 0 in fault

Alarms and Relays

The module offers two types of alarms, measurement and voted alarms. Relays are associated with voted alarms.

(1) Phase measurements are only valid when the speed used is from a TTL source.

Measurement Alarms

Measurement alarms provide for the customary threshold limits that are applied to selected measurements.

Alarm threshold limits can be entered into the configuration, normal mode, or can be read from Controller I/O, profile mode. 'Normal' mode permits the usual static limits. Profile mode lets the controller determine and send to the module the limit for any given machine state, such as an instance of an alarm 'profile' to be applied during a process cycle.

Table 18 - Measurement Alarms

Attribute	Description	
Number	24	
Input parameter	Any real time or discrete continuous measurement	
Alarm form	Over/under threshold	
	Inside/outside window	
Deadband	0…20% of limit	
Transducer state consideration	OK required	
	Not OK forces alarm	
	OK status is not considered	
Processing mode	Normal	Static limits that are applied
	Profile	Limits that are read from controller I/O
Delay times	Separate delay times for alert and danger alarms	
	0.10…60.0 s	
Sustain time	1.0 s (fixed)	
Set point multiplier Range: 0.1…100x	Multiply the threshold limits by this value when invoked. Can be:	
	Static	Enabled by controller I/O or manual switch
	Adaptive	Up to 5 multipliers that are defined for ranges of any third parameter (typically speed)

Voted Alarms

Voted alarms provide a voted logic solution that is based on the status of up to four measurement alarms.

Table 19 - Voted Alarms

Attribute	Description
Number	13
Input condition	Alert
	Danger
	Transducer fault

Table 19 - Voted Alarms

Attribute	Description
Latching	Non-latching, resets when condition clears
	Latching, after condition clears, resets upon command via controller I/O
Fail-safe	If assigned to a relay, when in alarm the relay coil is de-energized
Alarm logic	1oo1, 1oo2, 2oo2, 1oo3, 2oo3, 3oo3, 1oo4, 2oo4, 3oo4, 4oo4, 1oo2 AND 1oo2. 2oo2 OR 2oo2,1oo2 AND 2oo2, 2oo2 AND 1oo2
Logic inputs	1…4 measurement alarms
SPM timer	Number of seconds the SPM is applied after SPM signal is reset.
	From 0…65.5 s in 0.1 s increments
SPM control source	Controller I/O SPM control bit 0 or 1/digital input 0 or 1
Speed gating control	Speed reference: 0, 1
	Condition (>, <, <>, ><)
	Speed limits (low, high)
I/O gating control	Alarm is evaluated when gate condition is true
	Control on either of two controller output (I/O) bits
	Control on either of two digital inputs (hardware)
I/O Logix control	Alarm actuates when logic control is set
	Control on either of two controller output (I/O) bits
	Control on either of two digital inputs (hardware)

Relays

Relays are enabled and mapped to a voted alarm and selected faults. All logic that is associated with relay actuation on alarm is included in the voted alarm definition.(1) Logic that is associated with relay activation on fault is local to the relay.

Table 20 - Relay Logic Attributes

Attribute	Description
Number	13
Enable	Enable relay to assign it to a voted alarm
Voted alarm	Assign to any enabled voted alarm (0…12)
Faults	Main module fault Main module tachometer fault Expansion module fault Ethernet network fault Expansion bus fault
	If associated to a voted alarm that is configured fail-safe, main module fault is required
	Latching/non-latching

Event Management

The 1444 series manages events as follows:

- Optimizes behavior
- Uses alarm gating or adaptive limit multipliers
- Provides tools for recording the occurrence of events and data from an event

Event Log

The module includes a rolling (first-in, first out) event log, held in nonvolatile memory, which is in compliance with API-670.

Table 21 - Event Log Attributes

Attribute	Description
Event types	• System • Alarm • Buffer
Conditions	• 35 logged conditions • Categorized by event type
Number of entries	• 1500 total records • 256 records per event type
Time stamp resolution	0.1 ms

Trend and Alarm Capture

Comprised of static and dynamic data, the trend facility provides a source for real time/recent history/high density data without the need for continuous updates to an external data historian.

The alarm facility provides for the capture of data immediately before and after an alarm or receipt of a trigger from the controller signals an event. The alarm facility includes a copy of the trend buffers static and dynamic data. The static and dynamic data includes some samples after the trigger, plus a second set of static data that was captured at the maximum rate.

Table 22 - Trend and Alarm Capture Attributes

Attribute	Description	
Enable	Enable static data capture	
	Enable dynamic data capture	
Record content	Discrete data	Any number of measurements
	Dynamic data	TWF and FFT per channel
Trend Buffer		
Static data	Number of records: 640	
	Sample rate: N x 100 ms	
Dynamic data	Number of records: 64	
	Sample rate(1): N x 100 ms	
Alarm Buffer		
Trigger source	Controller output (I/O) control bit Any voted alarm (alert condition) Any voted alarm (danger) Any voted alarm (TX Fault)	
Saved trend buffer	640 static records	Includes N% records sampled post trigger
	64 dynamic records	Includes N% records sampled post trigger
High-resolution samples	320 static records	
	Sampled rate: 100 ms	

(1) How fast dynamic data can be written to Trend and Alarm buffers is dependent on the total module configuration. While a 1 second rate can be assured, a 100 millisecond rate cannot be possible.

(1) Expansion module relays can also be configured to act on fault (page 19).

Transient Capture

Comprised of static and dynamic data, the transient facility captures critical data necessary to diagnose machine condition during its run up (start) and run down (stop) events. The capabilities are designed to help ensure this capture regardless of whether; the event is scheduled or occurs unexpectedly, is a long or short duration event, or if the acceleration/ deceleration of the machine is fast, slow, or varying.

Table 23 - Transient Capture Attributes

Attribute	Description
Buffers	Four buffers each containing: • 640 discrete records • 64 dynamic records
	Discrete records: User defined, any discrete measures (OA, 1X magnitude, 1x phase, and so on) from any or all channels
	Dynamic records: TWF and FFT as defined for complex measurements. Complex data saved to transient buffers is limited to a maximum 2048 TWF samples and 900 FFT lines.
	Buffer type (assigned per buffer): • Startup • Coastdown
Overflow	When enabled allows buffers of up to 2560 discrete and 256 dynamic records
Definition	Speed Source: 0.1
	Transient minimum
	Transient maximum speed
	Startup: speed increases from under to over the maximum speed
	Coastdown: speed decreases from over to under the maximum speed
Sample Intervals	At delta RPM (off or 1…1000 RPM)
	At delta time (off or ≥ 1 second)
	Post startup time
	Dynamic records are captured every tenth trigger
Latching	If latching is enabled, then a buffer latches once it has been filled, so it has no remaining empty records.
	A latched buffer is not available for update until it is reset.

Time Synchronization

Time synchronization on EtherNet/IP is implemented by using CIP Sync. CIP Sync is a technology that is based on and fully compliant with the IEEE-1588 Standard Version 2 for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems. With the CIP Sync technology, synchronization between 1444 series modules and networked controllers down to 100 nanoseconds can be achieved.

Supported Network Topologies

The 1444 series offers two alternatives to the network solution applied. These alternatives include the common single-wire Ethernet networks and Device Level Ring networks for when a more fault-tolerant topology is required.

Single Ethernet

By using single Ethernet, as defined by IEEE 802.3, modules are connected in series on a common network. In this architecture, typically, the network is routed through adjacent modules by using one RJ45 connector as its input and the second connector as an output.

Device Level Ring

Device Level Ring (DLR) is a network topology that lets devices be connected in series, one-to-the-next, and back to the beginning, which forms a ring. Ring topologies offer a far simpler fault-tolerant network design that requires less cabling and can be installed at lower cost, while still providing a resilient, responsive solution.

Unlike typical ring solutions, DLR is deployed at the end devices, instead of the switches. So a DLR enabled device can connect directly to neighboring nodes. A ring topology at the device level greatly reduces the number of wires on the network, and the number of needed industrial Ethernet switches.

Fault Management

On detection of a fault, a Dynamix 1444-DYN04-01RA module provides indication via its status indicators, and communicates the status via controller I/O. Additionally, the single onboard relay can be configured to actuate based on any of the detected faults, see Table 24.

Table 24 - Main Module Fault Management Specification

Attribute	Description	
Expansion bus link time-out	100 ms (fixed)	
Fault actions		
Indication	Update status indicator (Table 7)	
Controller I/O	Status bits on controller input table	
Relay action	Select fault on any of(1)	Module*
		Expansion module
		Ethernet
		Expansion bus
	Latching/non-latching on fault	
	*Actuates on module fault if associated voted alarm configured fail-safe	

(1) If no fault action is defined for the relay of the main module, and the voted alarm that is associated with the relay is not configured Fail-Safe, the relay is held in its current position until the fault condition clears.

Controller I/O

The Dynamix 1444-DYN04-01RA module provides the following data in its controller input and output assemblies.

Input

The content of the input assembly is configurable, in module definition. At a minimum, the assembly consists of a fixed record of status information.

Additionally the input assembly can contain any number of measured values. These values include the real-time measurements that are listed in Table 12, the DC measurements in Table 13, and the continuous measurements that are listed in Table 14.

Table 25 - Controller Input Status Information

Control Bits	
Aux processor	DSP processor
Trend alarm	Transducer
Alarm status	Channel setup
Relay status	Expansion module

Output

The content of the output assembly is configurable, in module definition. The assembly includes various control bits, plus, when specified, speed values and alarm limits.

Table 26 - Controller Output

Control Bits	
Trip inhibit	Alarm buffer trigger
Set point multiplier enable	Alarm buffer reset
Alarm reset	Alarm gate control
Data	
Speed (2)	Alarm limits (16)

Tachometer Signal Conditioner Expansion Module 1444-TSCX042-02RB

The Dynamix 1444 series tachometer signal conditioner expansion module is a two-channel monitor that converts the signal from common speed sensing transducers into a once-per-rev TTL class signal suitable for use by 1444-DYN04-01RA dynamic measurement modules.

The 1444-TSCX02-02RB module is designed for use with a Dynamic Measurement module, which acts as its host, serving power and manages the configuration of the modules.

Table 27 - 1444-TSCX02-02RB Hardware Specifications

Attribute	Description
Channel Inputs (2)	
Sensor types	Voltage signals Eddy current probe systems TTL NPN proximity switch PNP proximity switch Self-generating magnetic sensors
Transducer positive power	Voltage regulated: 24V/25 mA
Transducer negative power	Voltage regulated: -24V/25 mA
Voltage range	± 24V
Isolation	Non-isolated, single-ended analog inputs. Connected sensors have their signal return isolated from ground

Table 27 - 1444-TSCX02-02RB Hardware Specifications

Attribute	Description	
Impedance	>100 kΩ	
Protection	Reverse polarity	
A/D converter	24 bit	
Raw Buffered Outputs (2)		
Connections	BNC	
Protection	Short circuit protected	
Voltage	± 20V	
Conditioned Buffered Outputs (4)		
Connections	Terminal pins	
Signal, 1/rev	TTL (2)	
Signal, N/rev	TTL (2)	
Power	5V DC, 35 mA max per output	
Local Bus Outputs (2)		
Connection	Integral, via ribbon connector	
Type	Opto-isolated open-collector	
Signal	TTL speed (once-per-rev)	
	Tach channel status	
Capacity	Can serve six main modules (1444-DYN04-01RA) (minimum)	
Power	5V DC, 5 mA max per output	
Indicators		
Status indicators (4)	Power Channel status (2) Local bus status	
Power		
Current	128 mA, 24V (174…104 mA, 18…32V)	
Consumption	4 W	
Dissipation	3 W	
Isolation	50V (continuous), basic insulation type between signal ports and AUX bus. No isolation between individual signal ports. Type Tested at 707V DC for 60 s.	
Environmental		
EFT/B immunity IEC 61000-4-4:	±2 kV at 5 kHz on shielded signal ports	
Surge transient immunity IEC 61000-4-5:	±2 kV line-earth(CM) on shielded signal ports	
Terminal Base		
Requires terminal base 1444-TB-B		
Removable Plug Connector Sets		
Module	Spring	1444-TSC-RPC-SPR-01
	Screw	1444-TSC-RPC-SCW-01
Terminal base	Spring	1444-TBB-RPC-SPR-01
	Screw	1444-TBB-RPC-SCW-01
Dimensions		

Table 27 - 1444-TSCX02-02RB Hardware Specifications

Attribute	Description
Definition	H: height above DIN rail
	W: width along DIN rail
	D: depth across DIN rail
Without terminal base (H x W x D)	65 x 54 x 154 mm (2.56 x 2.13 x 6.06 in.)
With terminal base (H x W x D)	96 x 54 x 158 mm (3.78 x 2.13 x 6.22 in.)
Weight	
Without terminal base	0.16 kg (0.35 lb)

Functional Specifications

Host Module Dependence

The tachometer signal conditioner module commonly serves speed signals to main modules other than its host. So, unlike other expansion modules, and except for configuration services, the 1444-TSCX02-02RB operates independently of its host module. Therefore, once configured, the tachometer signal conditioner module continuously serves TTL speed signals regardless of the state or availability of its host module or local bus.

Fault Management

On failure of self-test or on communication link failure, the tachometer signal conditioner module notifies its host module, if possible, and signals the condition via status indicators.

Table 28 - TSC Module Functional Specification

Attribute	Description	
Trigger	**Eddy Current Probes**	
	Auto Threshold(1)	Minimum signal amplitude: 2 volts peaks to peak
		Minimum freq: 12 cpm (0.2 Hz)
		Minimum pulse width: 25 µs
	Manual Threshold	Level: -32…+32V
		Minimum freq: 1 cpm (0.017 Hz)
	Self-generating Magnetic Pickups	
	Auto Threshold(1)	Threshold: 0.4V
		Hysteresis: 0.8V
		Minimum freq: 12 cpm (0.2 Hz)
	Manual Threshold	Level: -32…+32V
		Minimum freq: 1 cpm (0.017 Hz)
	TTL, NPN, and PNP proximity switch	
	Auto Threshold	Fixed trigger level dependent on sensor type
	Manual Threshold	Not available
Accuracy	± 3° of speed input for 1/rev up to 20 kHz	
Error	0.0167…4 Hz: ± 0.0033 Hz 4…200 Hz: ± 0.033 Hz 200…340 Hz: ± 0.083 Hz 340…2000 Hz: ± 0.333 Hz 2000…6000 Hz: ± 1.0 Hz 6000…20,000 Hz: ± 2.67 Hz	
Error	1…240 RPM: ± 0.2 RPM 240…12k RPM: ±2.0 RPM 12k…20.4k RPM: ±5.0 RPM 20.4k…120k RPM: ±20 RPM 120k…360k RPM: ±60 RPM 360k…1,200k RPM: ±160 RPM	
Fault Detection	Communication link time out: 1 second (fixed)	
Fault Action	Update module status indicator	

(1) Auto Threshold requires the 1444-TSCX02-02RB/B (series B) hardware.

Relay Expansion Module 1444-RELX00-04RB

The Dynamix 1444 series relay expansion module is a four-relay module that serves to add relays to its host module.

The 1444-RELX00-04RB Relay Expansion Module is designed for use with a Dynamic Measurement module that acts as its host, serving power, and manages the modules configuration.

Table 29 - 1444-RELX00-04RB Hardware Specifications

Attribute	Description	
Relay (4)		
Contact arrangement	Single pole double throw (SPDT) change-over contact	
Rating	250V AC/24V DC, 5 A max @ 40 °C (104 °F), 2 A @ 70 °C (158 °F)	
Indicators		
Status indicators (6)	Power Relay status (4) Local bus status	
Power		
Current	56 mA @ 24V (73…48 mA @ 18…32V)	
Consumption	1.6 W	
Dissipation	2.3 W	
Isolation voltage	250V (continuous), basic insulation type between relay ports and system Type tested at 1500V AC for 60 s	
Environmental		
EFT/B immunity IEC 61000-4-4:	±3 kV at 5 kHz on unshielded relay ports	
Surge transient immunity IEC 61000-4-5:	±1 kV line-line(DM) and ±2 kV line-earth(CM) on unshielded relay ports	
Terminal Base		
Requires terminal base 1444-TB-B		
Removable Plug Connector Sets		
Module	Spring	1444-REL-RPC-SPR-01
	Screw	1444-REL-RPC-SCW-01
Terminal base	Spring	1444-TBB-RPC-SPR-01
	Screw	1444-TBB-RPC-SCW-01
Dimensions		

Table 29 - 1444-RELX00-04RB Hardware Specifications

Attribute	Description
Definition	H: height above DIN rail
	W: width along DIN rail
	D: depth across DIN rail
Without terminal base (H x W x D)	65 x 54 x 154 mm (2.56 x 2.13 x 6.06 in.)
With terminal base (H x W x D)	96 x 54 x 158 mm (3.78 x 2.13 x 6.22 in.)
Weight	
Without terminal base	0.18 kg (0.40 lb)
With terminal base	0.28 kg (0.62 lb)
Wiring	
Wiring category(1),(2)	1 - on relay ports
Wire type	Unshielded on relay ports

(1) Use this Conductor Category information for planning conductor routing. See Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.
(2) Use this Conductor Category information for planning conductor routing as described in the appropriate System Level Installation Manual.

Functional Specifications

Host Module Dependence

The Relay Expansion module is designed to act as an extension of its host module. The operation of the 1444-RELX00-04RB module is dependent on the availability of its host.

A handshake communiqué between the relay expansion module and its host are executed continuously to verify communication and each modules operation. Failure of the Heartbeat™ constitutes a Link Failure condition on the relay module and a Module Fault on the main module.

Double-Pole Relays

When API-670 compliance or other applications require use of double-pole, double-throw (DPDT) relays, two expansion module relays can be paired.

Fault Management

If a Relay Expansion module fails self-tests (module fault) or detects a Link Failure, it actuates any relays that are configured as 'Fail-Safe' in the referenced voted alarm definition. Also, any relays that are configured to actuate on expansion bus fault.

Table 30 - Main Module Fault Management Specifications

Attribute	Description	
Communication link time-out	100 ms (fixed)	
Fault Actions		
Indication	Update status indicator (Table 27)	
Host notification	Local bus status indication	
Relay action	Select fault on any of:(1)	Module*
		Expansion bus
	Latching/non-latching	
	* Actuates on module fault if associated voted alarm configured fail-safe	

(1) If no fault action is defined for the relay, and the voted alarm that is associated with the relay is not configured Fail-Safe, the relay is held in its current position until the fault condition clears and the main module commands it otherwise.

Upon re-establishing communication to a relay module, a host module verifies the position of all relays, and commands each to be repositioned based on current alarm status and latching definition.

Analog Output Expansion Module 1444-AOFX00-04RB

The Dynamix 1444 series Analog Output Expansion Module is a four-channel module that outputs 4...20 mA analog signals that are proportional to measured values passed to it by the modules host module.

The 1444-AOFX00-04RB Analog Output Expansion module is designed for use with a Dynamic Measurement module, which acts as its host, serving power and manages the modules configuration.

Hardware Specifications

Table 31 - 1444-AOFX00-04RB Hardware Specifications

Attribute	Description
Channels (4)	
Current output	20 mA max per output
Protection	Insensitive to polarity
Accuracy	1 % full scale
Not OK output	Configurable: force low (2.9 mA), force high (>20 mA), hold current level
Indicators	
Status indicators (6)	Power Channel status (4) Local bus status

Table 31 - 1444-AOFX00-04RB Hardware Specifications

Attribute	Description	
Power		
Current	18 mA @ 24V (22…8 mA @ 18…32V)	
Consumption	0.76 W	
Dissipation	3.6 W	
Isolation voltage	50V (continuous), basic insulation type between signal ports and AUX bus. No isolation between individual signal ports. Type tested at 707V DC for 60 s	
Environmental		
EFT/B immunity IEC 61000-4-4:	±2 kV at 5 kHz on shielded signal ports	
Surge transient immunity IEC 61000-4-5:	±2 kV line-earth(CM) on shielded signal ports	
Terminal Base		
Requires terminal base 1444-TB-B		
Removable Plug Connector Sets		
Module	Spring	1444-AOF-RPC-SPR-01
	Screw	1444-AOF-RPC-SCW-01
Terminal base	Spring	1444-TBB-RPC-SPR-01
	Screw	1444-TBB-RPC-SCW-01
Dimensions		
Definition	H: height above DIN rail	
	W: width along DIN rail	
	D: depth across DIN rail	
Without terminal base (H x W x D)	65 x 54 x 154 mm (2.56 x 2.13 x 6.06 in.)	
With terminal base (H x W x D)	96 x 54 x 158 mm (3.78 x 2.13 x 6.22 in.)	
Weight		
Without terminal base	0.14 kg (0.31 lb)	
With terminal base	0.24 kg (0.53 lb)	
Wiring		
Wiring category(1),(2)	2 - on signal ports	
Wire type	Shielded on all signal ports	

(1) Use this Conductor Category information for planning conductor routing. See Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.
(2) Use this Conductor Category information for planning conductor routing as described in the appropriate System Level Installation Manual

Functional Specification

The analog output expansion module is designed to act as an extension of its host module. So therefore, operation of the 1444-AOFX00-04RB module is dependent on the availability of its host.

Fault Management

On failure of self-test or on communication link failure, if possible, the 4...20 mA Output module notifies its host module, signals the condition via status indicators and drives its outputs as specified by configuration, see Table 32.

Table 32 - Analog Output Module Functional Specification

Attribute	Description
Communication time-out	1 second (fixed)
Fault Actions	
Indication	Update module status indicator
Output behavior on fault options	No action
	Force low (<4 mA)
	Force high (>20 mA)

Terminal Bases

Each Dynamix module is installed in a terminal base that, when linked together, serve as the backplane of a 1444 series system.

Besides providing connections for common or 'dirty' wiring, the terminal bases provide two key capabilities for the system.

Addressing

The terminal base of the main module, the 1444-TB-A, includes a switch that is used to set the last octet of the IP address for the installed module. The address can be changed in firmware. The terminal base switch provides a portable, physical relationship that makes sure that modules installed are at the address set on the base rather than whatever can be in the memory of the module.

The expansion modules terminal base, the 1444-TB-B, also includes an address switch. However, in this case the switch is only used when a relay module is installed. In that case, the relay module must be set as 1, 2, or 3. Addressing for the tachometer signal conditioner expansion module and the analog output expansion module is automatic so does not use the switch.

Local Bus

Each terminal base includes the circuitry and connectors necessary to extend the local bus. A ribbon cable is included that is of a length suitable for connecting two adjacent terminal bases.(1)

The local bus is not interrupted when a module is removed. Removal or failure of any module does not affect tachometer signals, power, and local bus communication.

Terminal Base 1444-TB-A

Table 33 - 1444-TB-A Specifications

Attribute	Description
Module	1444-DYN04-01RA
DIN rail	35 x 7.5 mm according to EN 50022, BS 5584, or DIN 46277-6
Voltage range, input	North American: 18...32V, max 8A, Limited Voltage Source ATEX/IECEx: 18...32V, max 8A, SELV/PELV Source
Voltage range, auxiliary bus	18…32V, 1 A max
Physical	
Dimensions include module	
Dimensions (H x W x D)	116 x 103.5 x 155.5 mm (4.57 x 4.07 x 6.12 in.)
Weight	204.12 g (0.45 lb)
Removable Plug Connector Sets	
Spring clamp	1444-TBA-RPC-SPR-01
Screw clamp	1444-TBA-RPC-SCW-01

Terminal Base 1444-TB-B

All 1444 series expansion modules work with the same terminal base, 1444-TB-B.

Table 34 - 1444-TB-B Specifications

Attribute	Description
Modules	1444-TSCX02-02RB
	1444-RELX00-04RB
	1444-AOFX00-04RB

(1) Longer cables are available for use when jumping modules on adjacent DIN rails or when locating modules in other areas of a cabinet.

Table 34 - 1444-TB-B Specifications

Attribute	Description
DIN rail	35 mm x 7.5 mm according to EN 50022, BS 5584, or DIN 46277-6
Voltage range, input	North American: 18...32V, max 8A, Limited Voltage Source ATEX/IECEx: 18...32V, max 8A, SELV/PELV Source
Voltage range, auxiliary bus	18…32V, 1 A max
Physical	
Dimensions include module	
Dimensions (H x W x D)	90.2 x 54.7 x 155.5 mm (3.55 x 2.15 x 6.12 in.)
Weight	113.40 g (0.25 lb)
Removable Plug Connector Sets	
Spring clamp	1444-TBB-RPC-SPR-01
Screw clamp	1444-TBB-RPC-SCW-01

Configuration Software

The Rockwell Automation Logix controllers serve the configuration of 1444 series modules. After a powerup, or whenever a configuration is changed, the controller automatically pushes the configuration to the module.

The Add-on Profile is a program that executes within the Studio 5000® Engineering and Design Environment™. As part of Rockwell Automation Integrated Architecture, and by using a Studio 5000® Add-on Profile, the 1444 series configuration tools and processes are consistent with all other products that live within the Studio 5000 environment. This consistency makes sure that you spend less time learning the tools and more time defining their implementation.

The Dynamix 1444 Series is supported in Studio 5000 V24+ and in specific versions of V20 (contact Rockwell Automation regards availability of V20 solutions). Redundancy requires controller firmware V24.51+.

Table 35 - Controller Memory Requirements

Module Number	kB (apx)
1	50
2…N	15 ea

Condition Monitoring Software

Support for the Dynamix 1444 Series is included in our Emonitor® CMS (Condition Monitoring Software).

Catalog Number	Description
9309-CMS00ENE	Emonitor Condition Monitoring Software

CMS supports the 1444 Series through a suite of three new utilities including:

* Real Time Analyzer (RTA). The RTA is a freely deployed application that provides real-time visualization and analysis of TWF and FFT data read from any 1444 series dynamic measurement module. The RTA is intended to aid system installation and configuration, and to provide a simple tool to view current live data from any module, from anywhere, whenever required. The RTA does not require Emonitor to be installed on the personal computer, is not licensed separately, and requires only RSLinx® Lite to access network devices.

* Emonitor Extraction Manager (EEM). The EEM provides users a simple environment for mapping data from 1444 Series modules to an Emonitor database, and to define schedules for routine data acquisition. The output of the EEM is the input to the DDM.

* Data Download Manager (DDM). The DDM is a utility, which runs as a Windows Service, which executes data acquisition from any number of Dynamix modules following any number of schedules as defined by the EEM. Once sampled the DDM writes the data to standard Emonitor Unload Files.

Accessories

Available accessories include terminal plug connectors, extended interconnect cables, and a wide selection of industrial Ethernet cable solutions.

Ethernet Cable

The 1444 series are designed to operate in harsh industrial environments and possibly near electrically noisy or high-voltage devices and wiring.

When a Dynamix system is fully enclosed in a shielded environment (cabinet, metal conduit), unshielded media can be used. Otherwise, shielded, category Cat 5e (or 6), class D (or E) cables are recommended.

Ethernet cable accessories are provided by Allen-Bradley® 1585 Series Ethernet Media products.

Consult publications 1585-BR001 and M117-CA506 for further guidance in selection of a cable solution.(1)(2)

Removable Plug Connectors

1444 series modules are fitted with plug style connectors. The connectors let users wire the connections before installing the terminal base or module. The connectors also let you select between screw clamp and spring cage style terminal connector solutions as necessary for each application. As the modules and terminal bases are not shipped with included plug connectors, you must purchase the necessary connectors as listed in Table 36 and Table 37.

See Table 36 for Spring-style connectors or Table 37 for Screw-style connectors.

Table 36 - Spring-style Removable Plug Connectors

Spring Connectors	
Module	**Cat. No.**
1444-DYN04-01RA	1444-DYN-RPC-SPR-01
1444-TSCX02-02RB	1444-TSC-RPC-SPR-01
1444-RELX00-04RB	1444-REL-RPC-SPR-01
1444-AOFX00-04RB	1444-AOF-RPC-SPR-01
Terminal Base	**Cat. No.**
1444-TB-A	1444-TBA-RPC-SPR-01
1444-TB-B	1444-TBB-RPC-SPR-01

Table 37 - Screw-style Removable Plug Connectors

Screw Connectors	
Module	**Cat. No.**
1444-DYN04-01RA	1444-DYN-RPC-SCW-01
1444-TSCX02-02RB	1444-TSC-RPC-SCW-01
1444-RELX00-04RB	1444-REL-RPC-SCW-01
1444-AOFX00-04RB	1444-AOF-RPC-SCW-01
Terminal Base	**Cat. No.**
1444-TB-A	1444-TBA-RPC-SCW-01
1444-TB-B	1444-TBB-RPC-SCW-01

(1) Only Straight connectors are recommended for use with 1444 series modules.
(2) Be sure that the temperature rating of a selected cable is applicable to the environments that the 1444 series can be installed in, up to 70 °C (158 °F).

Interconnect Cables

In a Dynamix system, when expansion modules are used the modules are connected together via a local bus. A local bus is implemented by using a simple ribbon cable that spans one module to the next. The packaging for each terminal base includes a cable that is designed to the exact length necessary to connect two adjacent modules.

The extended interconnect cables provide a means to extend the local bus between terminal bases on different DIN rails, or in different areas of a cabinet.

Extended interconnect cables are rated to 300V and from -40...105 °C (-40...221 °F).

The accessory list, see Table 38, also includes a package of four standard length interconnect cables (1444-LBIC-04). These cables can be used to replace the cable that is included with each terminal base.

Table 38 - Interconnect Cable Accessories

Cat. No.	Description
1444-LBIC-04	Local Bus Interconnect Cable (qty 4)
1444-LBXC-0M3-01	Local Bus Extender Cable (0.3 m) (*)
1444-LBXC-1M0-01	Local Bus Extender Cable (1 m)

* Do not connect the RIGHT sides of two main modules, directly or through one or more expansion modules.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Publication 1444-TD001C-EN-P - March 2016
Supersedes Publication 1444-TD001B-EN-P - August 2015