Abstract

This purpose of this document is to assist users of older Bently Nevada proximity transducer systems when planning or implementing a transducer upgrade project. For now, we will limit our discussion to 5 and 8mm tip diameter systems typical of most API 670 installations for vibration, phase and position measurements, which should cover a majority of installations. The intent is to provide a general guideline to address part number cross reference, technical differences and similarities (physical and electrical) and most mounting/installation considerations to assist in your planning, but is not intended provide "step-by-step" instruction.

A Brief History/Overview of the different series

Since the mid 1970's there have been 3 significant design upgrades to the Bently Nevada (BN) proximity transducer system. The 7200 Series was introduced in the mid-70's to meet the requirements of the new and increasingly influential API 670 standard for vibration monitoring (currently in its 5th edition). End-users demanded standardization to simplify interconnectivity, stocking spare parts, and a host of other issues regarding proximity transducer based monitoring that were rather chaotic prior to API 670. The 7200 Series established the benchmark for average scale factor linearity, dimensional consistency, range, and interchangeability of components that is carried forward to modern day systems.

In the early 90's The 3300 Series system was introduced. The 3300 Series improved Proximitor accuracy, reliability, packaging and manufacturability. Performance specifications without significant increase in price. Probe tips were improved to strengthen probe/cable interface, and provide better pressure differential capability and sealing. Extension cables (and probe leads) were improved with a special "tri-axial" design that featured a second layer of wire braiding to provide and extra measure of mechanical protection and isolation.

7200 SERIES PROXIMITOR	3300 SERIES PROXIMITOR	3300XL SERIES PROXIMITOR

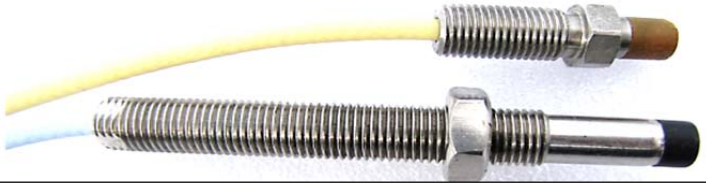
In the late 90's Bently Nevada introduced the 3300XL Series transducer system. By then, there were over a million channels installed worldwide and 40 years of accumulated knowledge in the field of monitoring and protecting rotating machinery. The improvements were many and significant. Below is only a few of the major improvements:

Proximitor Sensor

- Improved signal accuracy (Deviation from straight line and incremental scale factor)
- Improve temperature stability on standard option with available High-Temperature option
- Hi-density DIN mounting package with legacy mounting option
- European CE compliance
- Improved radio frequency interference (RFI) immunity

Probe and Cable

- Improved probe tip strength (better twist and pull resistance)
- Solved lube oil-wicking/oil sealing problem (with optional FluidLoc)
- Improved "ClickLoc" connectors on probe and cable



Top: 7200 Series probe (p/n 21508) Bottom: 3300XL Series probe (p/n 330101)

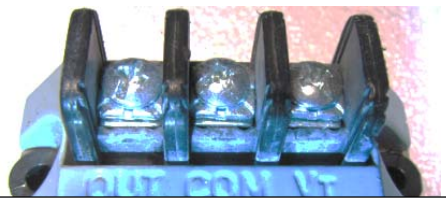
It is worth noting that all 3300XL and 3300 Series are backwards compatible with older BN monitoring systems. Some option reconfiguration may be needed.

Why upgrade?

- Cost: 3300XL Proximitor Sensors are about ¼ the price of a 7200 Series Proximitor.
- Availability: 3300XL Series delivery lead times are much shorter compared to 7200 Series lead times.
- Quality: 3300XL Series transducer systems are more accurate, provide better temperature stability, better mechanical robustness, and have greater RFI immunity.
- Life cycle considerations: the 3300XL is our flagship transducer system. Technology resources are continually devoted to improving the 3300XL line of transducers. 7200 Series, while still available for spare part replacement, is not a product that will receive any further improvement or enhancement. Further, 7200 Series could at any time move into the more advanced stages (currently in Phase 3 which means available for spare parts only) of obsolescence that could affect availability.
- Compliance: Euro and NA Hazardous area, RFI, CE
- Extended temper range: 500 F for probe lead and connector and extension cable, 350 F for probe tip.

Upgrade Considerations

- Before starting the actual upgrade, do a complete audit of the current installation. Record full part numbers of the transducer system and monitoring system modules if possible. Note gap voltage levels. This will save time in the planning and design phase of the upgrade project. Also, look for obvious problems and take corrective action or note then correct during the upgrade. The most basic indicator of a problem (and the easiest to check) is when the OK light on the monitor that the Proximitor system is connected to goes out. This can be a clue to problems such as damaged or faulty sensor components, faulty field wiring, too much or too little probe gap, bad connector/connection.
- Upgrading from 7200 Series to 3300XL Series is a fairly straightforward process as the 7200 and 3300 are for the most part similar in form and function. Similarities include scale factor, power requirements, target material calibration, most probe thread size and type, connector mating. Even though the 3300XL Series is compatible with all monitoring systems (7200, 3000 and 3500 Series), it is still prudent to perform a monitor calibration verification/configuration as part of the upgrade. See the proper BN monitor operations/maintenance manual for the procedure for your particular monitor type.
- It is *always* advisable to perform transducer calibration verification by running a probe calibration curve anytime a transducer sensor component is installed or replaced. BN Services or Tech Support can assist if you are not familiar with the procedure.
- Most 7200 probes, cables and Proximitors have a direct 3300XL replacement (see cross-reference chart below). There may be exceptions with some special or custom 7200 parts.
- When upgrading to 3300XL, ALL three components of the transducer system (Proximitor Sensor, probe and extension cable) must be replaced. You cannot mix 7200 and 3300/3300XL Series components.
- It is permissible to mix 3300 Series and 3300XL Series components. To get the full benefit from the 3300XL Series improvement listed above, however, we suggest using only "XL" Series components when upgrading and avoid mixing 3300 Series and 3300XL Series transducer components if possible. When XL and non-XL 3300-series 5 and 8 mm system components are mixed, system performance is degraded to the specifications for the <u>non-XL</u> 3300 5 and 8 mm Transducer System.
- One aspect of the new 3300XL Proximitor Sensor that needs to be considered is the Proximitor terminal block. The new 3300XL Proximitors feature a "Euro" style compression termination where the earlier Proximitors used the "Weidmuller" screw/lug style terminal block. Euro style terminations do not use wire lugs, so minor changes to the field wiring at the Proximitor end, such as removing the lug and stripping the wire, will be required.



3300XL Euro Terminals **3300 Weidmuller Terminals**

- Check the location's hazardous area classification for areas where explosive atmospheres may exist. Make sure all components have the proper area certification and the housing/enclosure is proper for your particular area classification.
- 8 mm diameter tip probes are physically stronger compared to 5 mm tip probes. Use 5 mm probes only when necessary. 5 mm probes are all 3300 Series, not 3300XL Series, so any system with 5 mm probes will only meet 3300 Series performance specification

Pre-upgrade check list

Since the machine will have to be down in order to install the new system components, all aspects of the existing installation should be inspected. Suggested upgrade pre-check list:

1. Housings and enclosures: The original 7200 Proximitor housing/enclosure can be used if it is in good condition. Check for corrosion, check seals/weather-stripping, fasteners and latches. The 3300XL Proximitor is designed either mount using the 7200 mounting hole pattern, or can be DIN rail mounted as well.
2. Field wiring and conduit: Check overall condition of cable noting any insulation cracking or other damage, overall conduit condition including any purging, termination blocks at both ends. Do not reuse damaged or worn field wiring. Also, any long field wiring runs greater than 1000 feet should be noted. Long cable runs act as a filter and will attenuate vibration amplitudes occurring at the upper end of the frequency range.
3. System grounding: All shields should be single-point grounded at the monitor location.
4. Shaft material: It is a good idea to make sure the shaft (target) material is 4140 steel or equivalent. If not, provide BN with the actual shaft material so special calibration Proximitors can be provided.
5. Shaft condition: make sure electrical and mechanical run out (glitch) is within acceptable levels. See API 670 for more details on run out.
6. Probe mounting and hardware: Check for overall condition; fastener tightness/safety wire, proper location and geometry; side clearance; target size; proper probe separation and orientation; proper cable sealing, anchoring and routing. Check for/correct any oil leaks through or around the probe threads/extension cables. This is a good time to consider improving the mechanical design of the probe installation. In other words, you may want to consider changing from internally mounted probes to a method that provides external adjustment/access.
7. Conduit and enclosure location: Review junction box, Proximitor enclosure location and conduit routing. Can the "plumbing" be changed to improve Proximitor access and access to critical field wiring connections/terminations. Sometimes it helps to have a secondary enclosure adjacent to the Proximitor housing to take up excess extension cable length (makes the inside of the Proximitor housing much "cleaner" and prevents chafing/premature failure of cables) instead of coiling up excess cable in the prox housing. If the existing conduit/enclosure is in the way of a footpath or interferes with machine maintenance, it should be re-routed/relocated.

8. Documentation: Update electrical design drawings to reflect new enclosures, new component part numbers (assures proper component matching); field wiring connection details; proper grounding. Mechanical design drawings: document any changes in probe bracketing or mounting method; how cables enter/exit the machine, seals, feed throughs; any modification to machine components such as holes drilled and tapped mounting probes or alterations required to facilitate/improve sensor mounting.
9. Sensor connections: Probe/extension cable connectors must be protected properly since poorly installed or maintained connectors are a common source of problems. Connector problems can be easily overcome by using BN Connector Protector or wrapping with silicon tape. BN advises ordering probes and extension cables with Connector Protectors or they can be order separately or in kits. In some special situations, you may consider eliminating the extension cable by purchasing probes in 5 or 9 meter lead lengths. Long probe leads may complicate the installation somewhat, but will eliminate the connector. When extension cables are used (which is typical in most all situations), take special care not to "burry" or cover them in the conduit or install in any manner that would prevent access. Adequate connector access will ease maintenance and save time when troubleshooting problems.
10. Environmental conditions: Note any harsh environments and select the appropriate proximity transducer system. Users need to consider all explosive or corrosive gases/liquids, all solutions with high or low pH levels, anhydrous ammonia exposure, extreme temperature conditions, etc., and assure the sensor components are fit for the environment to which they will be exposed.
11. Vibration Monitoring: Note gap voltage before removal of old probe, or note if there is a standard gap voltage used by the enterprise. Most users gap with the machine cold (machine stopped, lube system off) to the middle of the linear range using a voltmeter. The middle of the range of the typical 3300XL Proximitor sensor is about -10 Volts dc. The gap will decrease slightly when the machine is started as the shaft lifts on the oil and moves towards the probe (assuming probes are mounted in the upper part of the bearing). How much the gap changes depend on many factors, but there is usually plenty of the 80 mils of range remaining. Resetting the gap back to -10 volts is optional and probably unnecessary. What is important is gap voltage levels are rechecked and recorded as baseline data once the machine is at normal speed and load. Gap and position measurements can be as important to monitor as vibration levels in high-speed, critical rotating machinery.
12. Thrust or Axial Position Monitoring: Properly setting axial probes as part of an upgrade is more complicated compared to radial probes. Many of the same principals apply, but there are different measurement philosophies when monitoring the thrust collar position relative to the thrust bearing clearances. Weather the axial probes are zeroed in the middle of the "float" zone or zeroed when the rotor is forced against the active side of the bearing are two typical methods for setting the probes. The important thing to consider is thrust/axial measurements use up significantly more of the proximity sensor's linear range, so where and how you zero is more critical. The API 670 standard is a good reference and there are a

number of other good references available to assist with properly setting thrust position sensors.

13. Phase reference sensors: The Keyphasor sensor that observe a once-per-turn notch (on rare occasion, a projection) located somewhere along the shaft/coupling is another important measurement. The Keyphasor signal is used to index a known location on the shaft to the vibration signal. Combined, they are used to determine the degrees of rotation starting when the notch passes under the Keyphasor probe to when the shaft reaches it's closest point as observed by the vibration probe. This is defined as Phase Angle or Phase Lag. A phase angle measurement is compulsory for both machinery diagnostics and machine condition monitoring software, such as System 1. Redundant Keyphasor sensors may be a consideration, especially for System 1 users. System 1 loses most of its functionality without a valid Keyphasor signal. Some monitor parameters also require a Keyphasor, such as 1X and 2X amplitude and phase, and not 1X measurement.

Part number cross reference

PROXIMITOR AND EXTENSION CABLE				
7200 part	Description	3300XL part		
18745	Proximitor	330180		
21747	Extension Cable	330130		
PROBES				
7200 part	Tip Dia	Thread	Armor	3300XL part
21500	5 mm,	¼-28 thread	NO	330171
21501	5 mm	¼-28 thread	YES	330172
21504	8 mm	3/8-24	NO	330101
21505	8 mm	3/8-24	YES	330102
21508-02-12	Reverse Mount	3/8-24	NO	330105-02-12
22810	8 mm	M10 X 1	YES	330104
22811	8 mm	M10 X 1	NO	330103
22812	5 mm	M8 X 1	YES	330174
22813	5 mm	M8 X 1	NO	330173