# Cassandra Quick Reference Guide

This guide provides information on how to install Cassandra, as well as verify that the service is running. It also includes information on the Cassandra Data Mappings.

Cassandra, which is used for database management, must be set up prior to installing FuelsManager v12. If you are installing FuelsManager at the Enterprise, refer to the *Installing FuelsManager v12 at the Enterprise*. If you are installing FuelsManager at the base, refer to the *Installing FuelsManager v12 at a Base Site*.

❶ Install Cassandra

1) If you are configuring IM/SCADA, install the jre file, **jre-8u181-windows-x64.exe** before installing Cassandra.

2) Open the folder where the Cassandra installer is located, right-click on **VarecCassandraSetup.exe**, and select **Run as Administrator** to start the install. The InstallShield Wizard window displays.
   The InstallShield Wizard starts extracting the necessary files.

3) When prompted to begin the installation, click **Next**. The Setup Status screen displays the progress bar that shows InstallShield configuring the new software installation.
   This lasts a few minutes.

4) When the *InstallShield Wizard Complete* screen displays, click **Finish**.
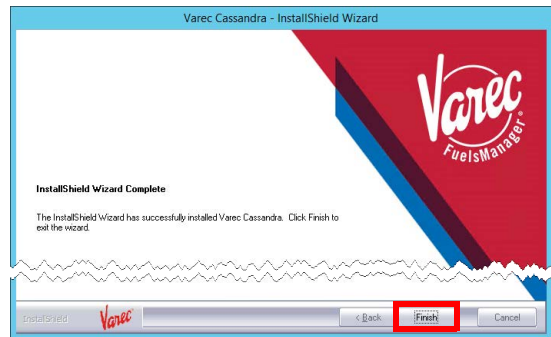

After completing Cassandra installation, a **VarecCassandraSetup.LOG** is created in C:\ProgramData. You can check the log if any errors occur during the install.

To view Cassandra data mappings for archive data, and how these values relate to the configuration (SQL DB), see the *Cassandra Data Mappings* section at the end of this document.
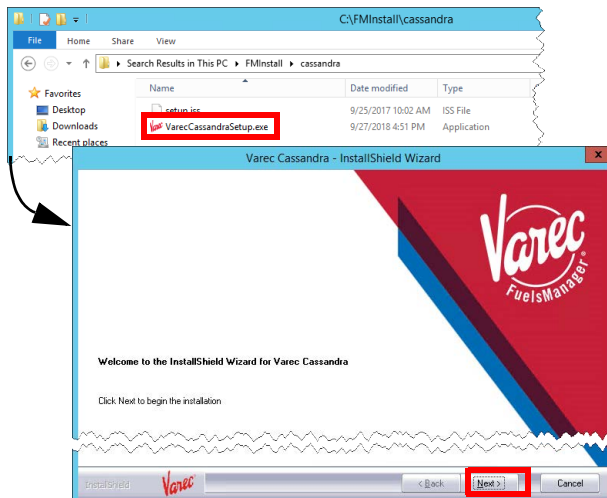
## ❷ Verify the Cassandra Service is Running

1) Open the **Services** folder.

2) Ensure that the Cassandra service is *Running*. If not running, **Start** the service.
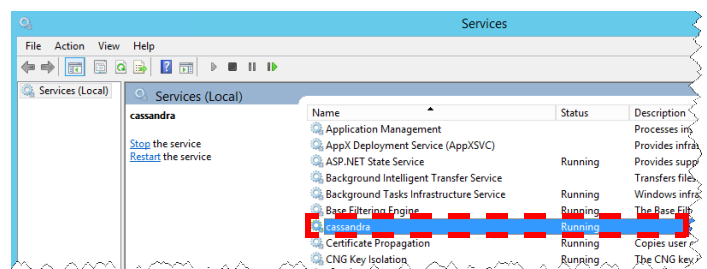
❸ Configure Java

Disable Automatic Java Updates

1) Access **Control Panel > Java** to open the Java Control Panel window.
2) Select the **Update** tab, and uncheck the *Check for Updates Automatically* option.
3) A warning message will appear. Click **Do Not Check**.
4) Click **OK** to save the Java setup.
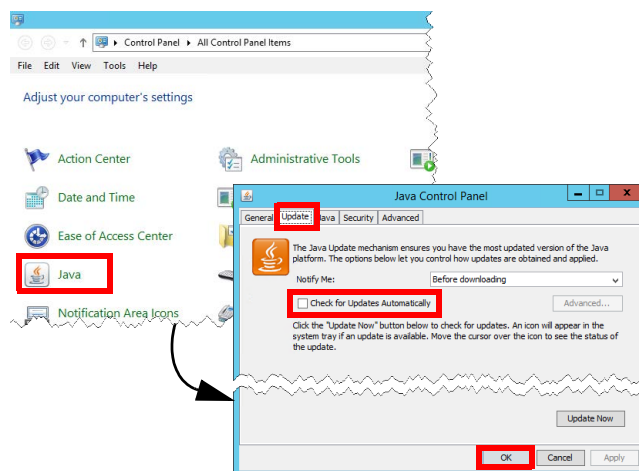
Set the Java Virtual Machine Memory

This will cap the maximum amount of RAM in GB that Cassandra can use.

1) Click the **Start** button on the task bar and type **Environment Variables**.
2) Select the **Edit the system environment variables** link.
3) In the **Advanced** tab click **Environment Variables**.
4) On the Environment Variables window, in the System variables area, click **New**.
5) On the New System Variable dialog, enter the Variable Name **_JAVA_OPTIONS**, and Variable Value **-Xms4g -Xmx8g**, and then click **OK** to save the values and close the dialog.
6) Click **OK** in the Environment Variables window, and then click **OK** in the System Properties window to complete the Java setup.

This setting is different from the Cassandra setting heap size. If the Virtual Machine memory is being limited, use this new limit in the calculation of the heap size.
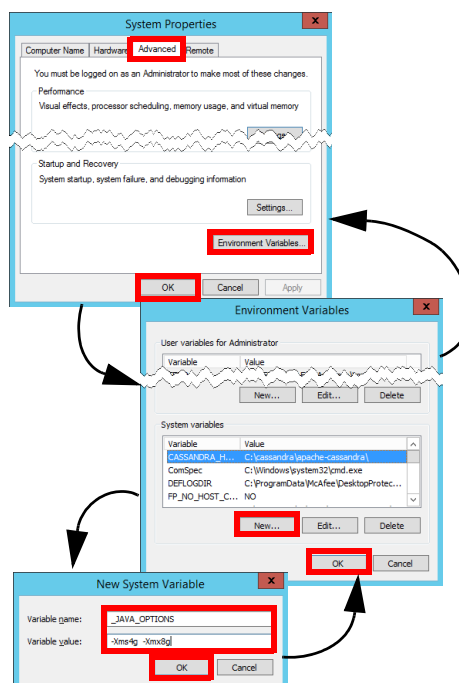
④ Configure Cassandra and Enterprise Settings

Perform only at the Enterprise! Configure Cassandra, if needed.

For a Cassandra Cluster, follow these steps:

1) Open **FuelsManager**.
2) From the menu, select **Administration > System > Configuration Settings**.
3) In the Find Text field, enter **Cassandra** and click **Find**.
4) Edit the following settings:
   - *Cassandra_Configuration* - enter **IP addresses** of all Cassandra nodes, separated by commas.
   - *Cassandra_ConsistencyLevel* = **Quorum**.
   - *Cassandra_ReplicationFactor* = **number of Cassandra nodes**
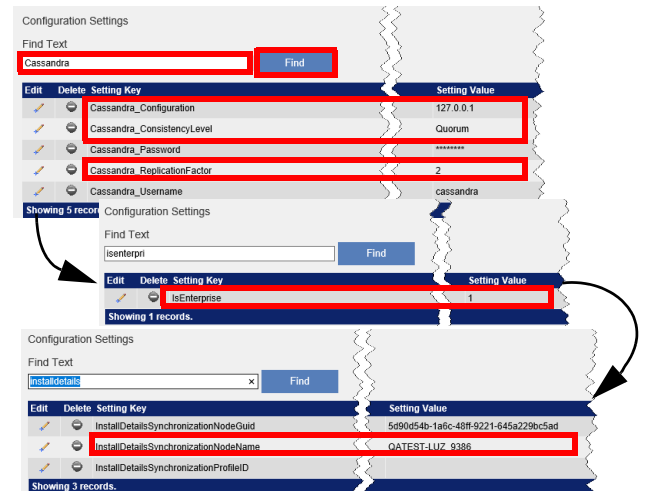
⑤ Enable Cassandra Authentication (Optional)

FuelsManager has the ability to provision a role to Cassandra, and update this role's username and password. Follow the steps below to enable basic authentication:

1) Edit cassandra.yaml to change the authenticator option to:
   authenticator: PasswordAuthenticator
2) Restart the **node**.
3) In FuelsManager, select **Administration > System > System Settings** from the menu.

4) Click **Configuration Settings**. The Configuration Settings page displays.
5) Edit and save the key *CassandraUsername*. A good practice would be to use a simple name indicative of FuelsManager.
6) Edit and save the key *CassandraPassword*. A strong password is recommended.

Authentication is now Enabled. You need to log out of FuelsManager and log back in to finalize your changes to the Configuration Settings.

⑥ Verify Cassandra Configuration Settings

Perform only at the Terminal!

To access the Configuration Settings, follow these steps:

1) Open **FuelsManager**.
2) From the menu, select **Administration > System Settings**.
3) On the System Settings Configuration page, click **Configuration Settings**.
4) Verify that the following Cassandra Setting Keys are set to the correct values:

Cassandra_Configuration	Cassandra_ReplicationFactor
Cassandra_ConsistencyLevel	Cassandra_Username
Cassandra_Password	

By default, the Cassandra setting keys are set for running Cassandra on the same server.
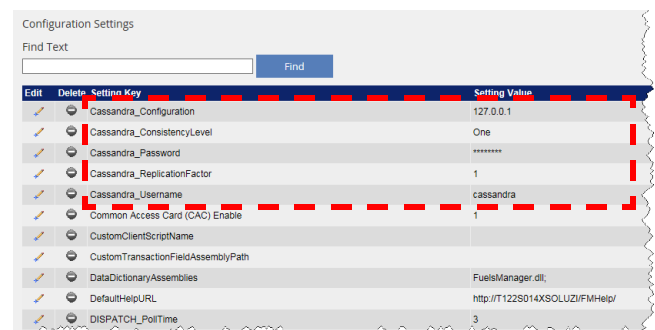
❼ **Verify Days to Retain Archives in Cassandra**

To prevent the Cassandra folder from filling up, you may define the number of days to retain archives at either Enterprise or the individual Site.

Default: 365 days to retain archives in Cassandra < Keyspace < FMArchive_Data
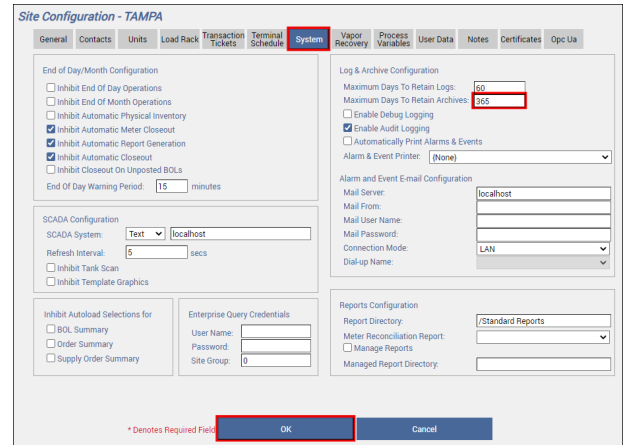
Follow these steps:
1) Open **FuelsManager**.
2) From the menu, select **Administration > Sites > Sites**. The Sites Configuration page displays.
3) Click the **Edit** ✎ icon next to the Site you want to modify. A multi-tab page displays.
4) Select the **System** tab.
5) Verify that the *Maximum Days to Retain Archives* is set to **365** (or less).
6) Click **OK** to save your changes.

Data that is >= 365 days is automatically deleted to prevent filling up the hard drive, except for Cassandra Alarms & Events, which are permanently retained in Cassandra < Keyspace < FMAandEArchive_Data.

Cassandra Data Mappings

The following table shows the Cassandra data mappings for archive data in FuelsManager v12. This only covers the fields that are in-place for archive data. Some of the columns are used by the Trend display and do not apply for retrieving archive data.

Keyspace: FMArchive_Data
Table: valuearchivedata

Designation	Column Designation	Cassandra Datatype	Example Data	Description
Point Value Guid	A	uuid		Contains the Tag Guid associated with the archived data.
Property ID	B	varchar	ProductTable, BottomsTable, SolidsTable, ProductID, Undefined, RoofMassInStrap, NULL	Text data if a property ID is present. Null if not.
Partition	C	bigint	2021.03	Cassandra Data partitioning scheme. Timestamp year * 100 + timestamp month. Determines how data is stored.
Value	D	varchar	-9.5	String representation of the value data for the above tag.
Value OPC UA Status	E	bigint	0	Value of the status of the selected tag. See the OPC UA status document for status determination. 0 = Good, 0x800000000 = Bad, Etc…

Designation	Column Designation	Cassandra Datatype	Example Data	Description
Value Time Stamp	F	timestamp	2021-03-18 08:14:45	Time that the tag value last changed
Archive Record Type	G	int	3	Indicates the type of record. 3 = data archive record. Currently only type 3 is implemented.
Value Data Type	H	varchar	System.Double, System.String, FMBusinessObjects. DataObjects. CodedVariables. RoofTypeEnum	String determining the type that the value above is. See list below for a list of available FMBusinessObjects CodeVariables options.
Value Engineering Unit	I	int	46, 162	Numeric value that determine the associated engineering units with the above value. See list below.
Alarm Priority Guid	J	uuid	*	*
Alarm Acknowledged	K	boolean	*	*
Alarm State	L	varchar	*	*
Alarm Changed	M	boolean	*	*
Record Time Stamp	N	timestamp	2021-03-18 08:14:45	Time the record was written to Cassandra. Note that a complete set of records are written on startup and at midnight of each day when running.
Quality String	O	varchar	*	*

*These values are used by the historical trend display and have no useful information for the archive. To access actual alarm and event data the user should get this data from the FMAandEArchive_Data key space.

The following table shows the Cassandra data mappings for archive data in FuelsManager v12.

Keyspace: FMAandEArchive_Data
Table: archivedata

Designation	Column Designation	Cassandra Datatype	Example Data	Description
Point Description	A	varchar	Tank Point 1	Point description field text.
Alarm Guid	B	uuid	ead8025f-4791-45c1-b45b-4511d0cb2877	Guid assigned to the associated alarm.
Alarm Test Guid	C	uuid	f8a041db-3bf0-402b-85db-6aff3324ee71	Guid assigned to the associated alarm test cases.
Point	D	varchar	Tank-03	Configured point name.
Site	E	varchar	SiteAdmin	Name of the associated site.
Site Guid	F	uuid	00000000-0000-0000-0000-000000000001	Guid of the associated site.
Date and Time	G	timesatamp	2021-03-29 11:07:12	Date and Time of the alarm event.
Alarm State	H	varchar	Max Op Alarm, Low Alarm	Alarm state for this record.

Designation	Column Designation	Cassandra Datatype	Example Data	Description
Point Type	I	varchar	Tank	Point type associated with this alarm event.
Variable	J	varchar	Level Product, Tank Mode Discrete Alarm	Tag name for the associated alarm event.
Value	K	varchar	37.653	String representation of the value that exceeded or caused the alarm event.
Units	L	varchar	FmuNone, FmlFtIn16Th	String representation for the configured engineering units for the associated variable.
Priority	M	varchar	1, 2, 3	Assigned alarm priority for this alarm event.
Action	N	varchar	Alarm, Normal, Acknowledged	Event for this alarm record.
User	O	varchar	Administrator, blank	User responsible for this record. Only used for Acknowledgment alarm record.
Comments	P	varchar	Caused by accident	User entered comment when acknowledging the associated alarm.
Record Type	Q	int	1	Always 1 for an alarm record.
Record Guid	R	uuid	e6a48cfa-98e4-4025-a4b3-765947a652a0	Unique Guid assigned to this alarm record.
Comment User	S	varchar	Administrator	Name of the user who entered the associated comment.
Comment Date/Time	T	timestamp	2021-03-29 11:07:12	Date and time that the comment was entered.
Partition	U	bigint	20210322	Cassandra Data partitioning scheme. Timestamp year * 10000 + timestamp month. * 100 + timestamp.day Determines how data is stored.

Appendix A: FMBusinessObjects Code Variables and Symbolic Units

RoofTypeEnum

NoRoof

FixedRoof

RoofMassInStrap

RoofMassNotInStrap

TankTransferStatuses

Inactive

TransferTarget

InProgress

Complete

Engineering Units

FmSiteUnits = 0,

Temperature Units

FmtDegC = 1,   // Degrees Celsius

FmtDegF = 2,   // Degrees Fahrenheit

FmtDegK = 3,   // Degrees Kelvin

FmtDegR = 4,   // Degrees Rankine

TankStatuses

Stopped

Filling

Emptying

Running

Testing

TankCommands

Stop

Fill

Empty

Run

Reset

Time Units

FmtMsec = 5,   // Milliseconds

FmtSec = 6,   // Seconds

FmtMin = 7,   // Minutes

FmtHour = 8,   // Hours

FmtDay = 9,   // Days

FmtWeek = 10,   // Weeks

FmtMonth = 11,   // Months

FmtYear = 12,   // Years

TankTransferModes

Inactive

Level

Batch

TankOperationalMode

Normal

Quarantined

Market

Engineering Unit Type

FmuAll = 0,   // All Units

FmuTemp = 1,   // Temperature Units

FmuTime = 2,   // Time Units

FmuLength = 3,   // Length Units

FmuArea = 4,   // Area Units

FmuVolume = 5,   // Volume Units

FmuMass = 6,   // Mass/Weight Units

FmuPressure = 7,   // Pressure Units

FmuVolflow = 8,   // Volumetric Flow

FmuMassflow = 9,   // Mass Flow

FmuVelocity = 10,   // Velocity/Rate

FmuDensity = 11,   // Density Units

FmuEnergy = 12,   // Energy Units

FmuPower = 13,   // Power/Heat XFR

FmuElect = 14,   // Electrical

FmuNodim = 15,   // Dimensionless

FmuNone = 16,   // Invalid

Length Units

FmlFtIn8th = 19,   // Feet/Inches/8ths

FmlMm = 20,   // Millimeters

FmlCm = 21,   // Centimeters

FmlMeter = 22,   // Meters

FmlKm = 23,   // Kilometers

Fml16th = 24,   // 1/16 inch

FmlInch = 25,   // Inches

FmlFeet = 26,   // Feet

FmlFtIn16th = 27,   // Feet/Inches/16ths

FmlYard = 28,   // Yards

FmlMile = 29,   // Miles

Area Units

FmaMm2 = 30,	// Millimeters Sq
FmaCm2 = 31,	// Centimeters Sq
FmaMeter2 = 32,	// Meters Sq
FmaKm2 = 33,	// Kilometers Sq
Fma16TH2 = 34,	// 1/16 inch Sq
FmaInch2 = 35,	// Inches Sq
FmaFeet2 = 36,	// Feet Sq
FmaYard2 = 37,	// Yards Sq
FmaMile2 = 38,	// Miles Sq

Volume Units

FmvCm3 = 40,	// Cubic centimeters
FmvMeter3 = 41,	// Cubic meters
FmvLitre = 42,	// Litres
FmvInch3 = 43,	// Cubic inches
FmvFeet3 = 44,	// Cubic feet
FmvYard3 = 45,	// Cubic yards
FmvUSGal = 46,	// US Gallons
FmvImpGal = 47,	// Imp Gallons
FmvBlOil = 48,	// Barrels Oil
FmvBlLiq = 49,	// Barrels Liquid
FmvKl = 50,	// Kilolitres
FmvMsFt3 = 51,	// 1000 standard cubic feet

Mass Units

FmmGram = 60,	// Grams
FmmKg = 61,	// Kilograms
FmmMTon = 62,	// Metric Tons
FmmOz = 63,	// Ounces
FmmLb = 64,	// Pounds
FmmETon = 65,	// English Tons
FmmSTon = 66,	// Short Tons
FmmLTon = 67,	// Long Tons
FmmMlbs = 68,	// Thousands of Pounds

Pressure Units

FmpPa = 70,	// Pascal (SI)
FmpKPa = 71,	// Kilopascal
FmpKgCm2 = 72,	// Kg per sq cm
FmpPsi = 73,	// lb per sq inch
FmpPsiG = 74,	// PSI Gauge
FmpPsiA = 75,	// PSI Absolute
FmpInH2O = 76,	// In. H2O (@ 68F)
FmpFtH2O = 77,	// Ft. H2O (@ 68F)
FmpInHg = 78,	// In. Mercury (@ 0C)
FmpLbFt2 = 79,	// Pounds per square foot
FmpTorr = 80,	// Torr (@ 0C)
FmpBar = 81,	// Bar
FmpMBar = 82,	// Millibar
FmpMmHg = 83,	// mm Hg (@ 0C)
FmpMmH2O = 84,	// mm H2O (@ 68F)
FmpGmCm2 = 85,	// Grams per square cm
FmpAtm = 86,	// Atmospheres

Volumetric Flow Units

FmvfCcMin = 90,	// CC/Min
FmvfCcHr = 91,	// CC/Hour
FmvfM3Sec = 92,	// m3/sec
FmvfM3Min = 93,	// m3/Minute
FmvfM3Hr = 94,	// m3/Hour
FmvfM3Day = 95,	// m3/Day
FmvfLtSec = 96,	// Litre/sec
FmvfLtMin = 97,	// Litres/minute
FmvfLtHr = 98,	// Litres/Hour
FmvfMlpd = 99,	// Million litres/day
FmvfIn3Min = 100,	// Cubic inches/minute
FmvfIn3Hr = 101,	// Cubic inches/hour
FmvfFt3Sec = 102,	// Cubic feet/second
FmvfFt3Min = 103,	// Cubic feet/minute
FmvfFt3Hr = 104,	// Cubic feet/hour
FmvfFt3Day = 105,	// Cubic feet/day
FmvfYd3Min = 106,	// Cubic yards/minute
FmvfYd3Hr = 107,	// Cubic yards/hour

Volumetric Flow Units (continued)

FmvfGps = 108,	// Gallons/sec (US)
FmvfGpm = 109,	// Gallons/minute (US)
FmvfGph = 110,	// Gallons/hour (US)
FmvfMGpd = 111,	// Millions of gallons/day (US)
FmvfImpGps = 112,	// Imp gallons/sec
FmvfImpGpm = 113,	// Imp gallons/minute
FmvfImpGph = 114,	// Imp gallons/hour
FmvfImpMgd = 115,	// Imp millions of gallons/day
FmvfBpMoil = 116,	// BBL/min (oil)
FmvfBpHoil = 117,	// BBL/hour (oil)
FmvfBpDoil = 118,	// BBL/day (oil)
FmvfMbDoil = 119,	// Millions barrels/day (oil)
FmvfBpMliq = 120,	// BBL/min (liq)
FmvfBpHliq = 121,	// BBL/hour (liq)
FmvfBpDliq = 122,	// BBL/day (liq)
FmvfMbDliq = 123,	// Millions barrels/day (liquid)
FmvfKlSec = 124,	// kilolitres/sec
FmvfKlMin = 125,	// kilolitres/Minute
FmvfKlHr = 126,	// kilolitres/Hour
FmvfKlDay = 127,	// kilolitres/Day

Mass Flow Units

FmmfLbSec = 130,	// Pounds/sec
FmmfLbMin = 131,	// Pounds/minute
FmmfLbHr = 132,	// Pounds/hour
FmmfLbDay = 133,	// Pounds/day
FmmfMTonMn = 134,	// Metric tons/minute
FmmfMTonHr = 135,	// Metric tons/hour
FmmfMTonDy = 136,	// Metric tons/day
FmmfSTonMn = 137,	// Short tons/min
FmmfSTonHr = 138,	// Short tons/hour
FmmfSTonDy = 139,	// Short tons/day
FmmfLTonMn = 140,	// Long tons/min
FmmfLTonHr = 141,	// Long tons/hour
FmmfLTonDy = 142,	// Long tons/day
FmmfGmSec = 143,	// Grams/sec
FmmfGmMin = 144,	// Grams/minute
FmmfGmHr = 145,	// Grams/hour

Mass Flow Units (continued)

FmmfKgSec = 146,	// Kilograms/sec
FmmfKgMin = 147,	// Kilograms/minute
FmmfKgHr = 148,	// Kilograms/hour
FmmfKgDay = 149,	// Kilograms/day
FmmfMlbSec = 150,	// Millions of Pounds/sec
FmmfMlbMin = 151,	// Millions of Pounds/minute
FmmfMlbHr = 152,	// Millions of Pounds/hour
FmmfMlbDay = 153,	// Millions of Pounds/day

Velocity and Rate Units

FmvrIps = 160,	// Inches/sec
FmvrFps = 161,	// Feet/sec
FmvrFpm = 162,	// Feet/min
FmvrMmSec = 163,	// Millimeters/sec
FmvrCmSec = 164,	// Centimeters/sec
FmvrMSec = 165,	// Meters/sec
FmvrMMin = 166,	// Meters/min
FmvrMph = 167,	// Miles per hour
FmvrMrph = 168,	// Meters per hour
FmvrKmph = 169,	// Kilometers per hour
FmvrKnot = 170,	// Knots
FmvrMmMin = 171,	// Millimeters/min

Density Units

FmdGcm3 = 180,	// Grams/cubic cm
FmdGMl3 = 181,	// Grams/millilitre
FmdGl3 = 182,	// Grams/litre
FmdKgM3 = 183,	// Kilograms/cubic meter
FmdKgL3 = 184,	// Kilograms/litre
FmdLbIn3 = 185,	// Pounds/cubic inch
FmdLbFt3 = 186,	// Pounds/cubic feet
FmdUsLbGal = 187,	// Pounds/gallon
FmdImpLbGl = 188,	// Pounds/gallon (imperial)
FmdLbBlOil = 189,	// Pounds/barrel (oil)
FmdLbBlLiq = 190,	// Pounds/barrel (liquid)

Density Units (continued)

FmdDegApi = 191,	// Degrees API
FmdSpGrav = 192,	// Specific gravity
FmdPrPlato = 193,	// % Plato
FmdDegBrix = 194,	// Degrees BRIX
FmdDegBmLt = 195,	// Degrees Baum (light)
FmdDegBmHy = 196,	// Degrees Baum (heavy)
FmdSTnYd3 = 199,	// Short tons/cubic yard

// The following are considered obsolete and never used.

FmdDegTwad = 197,	// Degrees Twaddell
FmdDegBal = 198,	// Degrees Balling

Energy

FmeBtu = 200,	// BTU
FmeCal = 201,	// Calories
FmeJoule = 202,	// Joules (SI)
FmeWh = 203,	// Watt-hours
FmeKwH = 204,	// Kilowatt-hours

Power and Heat Transfer Units

FmphBtuSec = 210,	// BTU/sec
FmphBtuMin = 211,	// BTU/min
FmphBtuHr = 212,	// BTU/hour
FmphCalMin = 213,	// Cal/min
FmphWatt = 214,	// Watts
FmphKWatts = 215,	// KiloWatts
FmphKVAmp = 216,	// Kilo Volt-Amps
FmphHPower = 217,	// Horsepower

Electrical Units

FmeuMVolts = 220,	// Millivolts
FmeuVolt = 221,	// Volts
FmeuMAmps = 222,	// Milliamps
FmeuAmp = 223,	// Amps
FmeuOhm = 224,	// Ohms
FmeuFarad = 225,	// Farads
FmeuCoul = 226,	// Coulombs
FmeuHenry = 227,	// Henrys
FmeuMicSie = 228,	// MicroSiemens
FmeuSiemen = 229,	// Siemens
FmeuMho = 230,	// MHOs

Dimensionless Units

FmduPwrFct = 231,	// Power factor
FmduRpm = 232,	// Revolutions/min
FmduHertz = 233,	// Cycles/sec (Hz)
FmduPCent = 234,	// Percent (general)
FmduPpm = 235,	// Parts per mill
FmduPHumid = 236,	// % Humidity
FmduPOxygn = 237,	// % Oxygen
FmduRHumid = 238,	// Relative Humidity
FmduPh = 239,	// pH

Miscellaneous Units

FmmuCentp = 240,	// Centipoise
FmmuSolWt = 241,	// Solids by weight
FmmuSolVol = 242,	// Solids by volume
FmmuStQual = 243,	// Steam quality
FmmuBushel = 244,	// Bushels
FmmuPrfVol = 245,	// Proof volume
FmmuPrfMas = 246,	// Proof mass
FmmuFt3Lb = 247,	// Cubic feet/pound
FmuNone = 255,	// No Units