

```
80  double PIDImpl::calculate( double setpoint, double pv )
81  {
82
83      // Calculate error
84      double error = setpoint - pv;
85
86      // Proportional term
87      double Pout = _Kp * error;
88
89      // Integral term
90      _integral += error * _dt;
91      double Iout = _Ki * _integral;
92
93      // Derivative term
94      double derivative = (error - _pre_error) / _dt;
95      double Dout = _Kd * derivative;
96
97      // Calculate total output
98      double output = Pout + Iout + Dout;
99
100     // Restrict to max/min
101     if( output > _max )
102         output = _max;
103     else if( output < _min )
104         output = _min;
105
106     // Save error to previous error
107     _pre_error = error;
108
109     return output;
110 }
```